JULY 1961

Precision Metal Molding

INCLUDING DIE CASTINGS MAGAZINE

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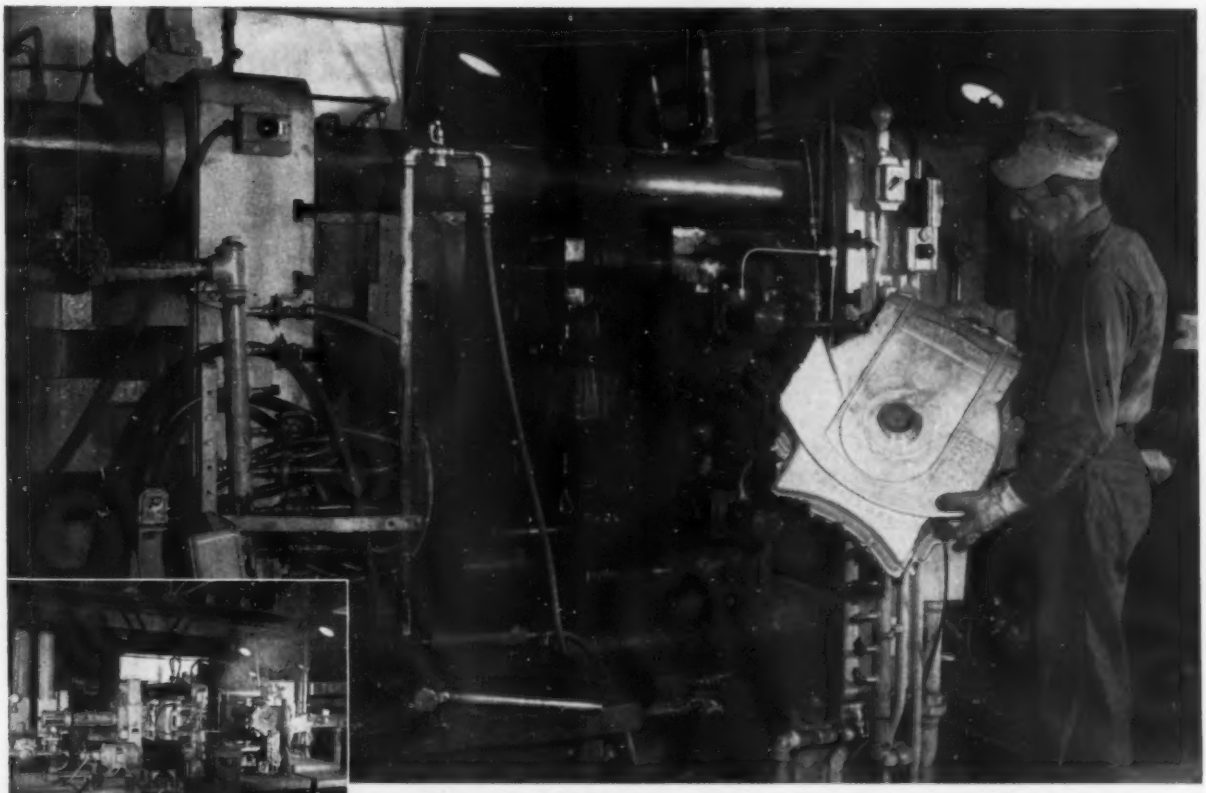
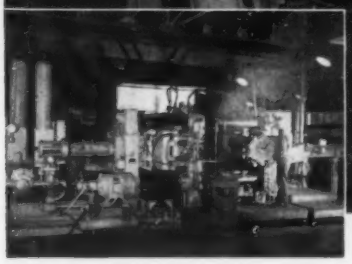


● Big, solid 17 lb. castings are housings for rotary power lawn mowers. Production averages 80 housings per hour. This is a 1000-ton Cast-Master Die Casting machine — one of two in this plant.



● All operating elements of this efficient 1000-ton Cast-Master are conveniently accessible for instant adjustment or inspection.

● Cast housings are removed from die, inspected and then dunked in the cooling tank at right. Parts are conveyor fed to trimming presses, then drilled and cleaned prior to assembly.

● Minor finishing is required after trimming. The racks in background represent about one-half hour's production for one machine.

"CAST-MASTER'S TOGGLE CLAMPING GIVES US UNIFORM DENSITY-LESS FLASH"

G. L. Graft, Divisional Supt. for The Newark Ohio Company Newark, Ohio stated, "We like Cast-Master's die locking toggle mechanism and the rugged qualities of these machines. They've been doing a fine job for us on all sizes of castings up to 17 lbs. each. They're fast; scrap loss and flash are negligible." This company manufactures Kenmore Electric Ranges and Craftsman Rotary Power Lawn Mowers, exclusively for Sears, Roebuck and Company.

If you're moving into the die casting field involving new, larger castings, investigate the Cast-Master line of high production die casting machines — 100-ton to 2000-ton capacities—cold chamber or hot chamber models. Write for Bulletin CM-100.

HZ6

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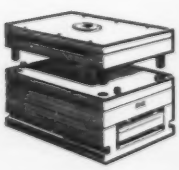
61-A-DC



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Many advantages are gained by designing for powdered metal gears, as described in this third article in a series on powder metallurgy applications.

28 **IMPACT EXTRUSIONS**
Better properties at low cost plus good heat dissipation are had by designing for impact extrusion.

30 **THIS IS GOOD DIE CASTING DESIGN**
Just about every major advantage of die casting is utilized in manufacturing a durable, low cost egg beater.

32 **NON-FERROUS POWDER METALLURGY AWARDS**
Here are all of the New Jersey Zinc Company non-ferrous powdered metal parts winners for 1961 other than the grand prize winners listed in the June issue.

34 **SELF-FASTENING EXTRUSION USED FOR SUN SCREEN FRAME**
When Brog-Warner wanted strong framework for KoolShade sun screens, it chose aluminum extrusions.

36 **BLENDING METAL POWDERS**
Using the right blenders and the right equipment, you get good quality metal powders.

38 **INVESTMENT CASTING REPLACES MACHINED PARTS**
To drill and shave a casting costs a good deal less than machining and assembling parts.

38 **VARIABLE THICKNESS IS NO PROBLEM**
This investment casting is heat treated to spring temper.

38 **ONE CASTING, NOT MULTIPLE STAMPINGS**
The Minicast process helped cut costs in manufacturing a small investment casting.

39 **GOOD WEAR AND CONDUCTIVITY WITH BERYLLIUM COPPER**
An electric relay yoke is investment cast.

39 **TOO FRAGILE, TOO SMALL, TOO INTRICATE**
Hi-Fi components, too small to machine, are economically investment cast.

40 **BETTER LIGHTING WITH EXTRUDED LOUVERS**
With properly designed lighting fixture louvers, a room has maximum lighting benefits.

42 **GATING ZINC DIE CASTINGS**
What is the best arrangement for gating multiple cavities? This problem is discussed as part III in a series.

66 **NINE FILL TOP MPIF POSITIONS**
Nine new officers fill the top positions of the Metal Powder Industries Federation and its trade associations.

70 **DIE CASTINGS CAN BE ADHESIVE BONDED**
By adhesive bonding two aluminum castings, one manufacturer cut production costs 50%.

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Minor modifications to part shape can make finishing the surface area a fast and low cost operation.

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SUBSCRIPTIONS in U.S. and possessions: $7 1 year; $12, 2 years. Canada: $8.50 per year. Foreign: $10 per year, payable in advance in U.S. funds. U.K.: £ 3.5.0 per year payable in Sterling to London office. Single copies when available: 1 to 10 – 75¢ each; 11 to 25 60¢ each; over 25 45¢ each.

Out of print copies of PRECISION METAL MOLDING are available in complete volumes as positive microfilm copies from University Microfilms, 313 N. First St., Ann Arbor, Mich.

published monthly by
The INDUSTRIAL PUBLISHING CORPORATION
812 Huron Rd., Cleveland 15, Ohio

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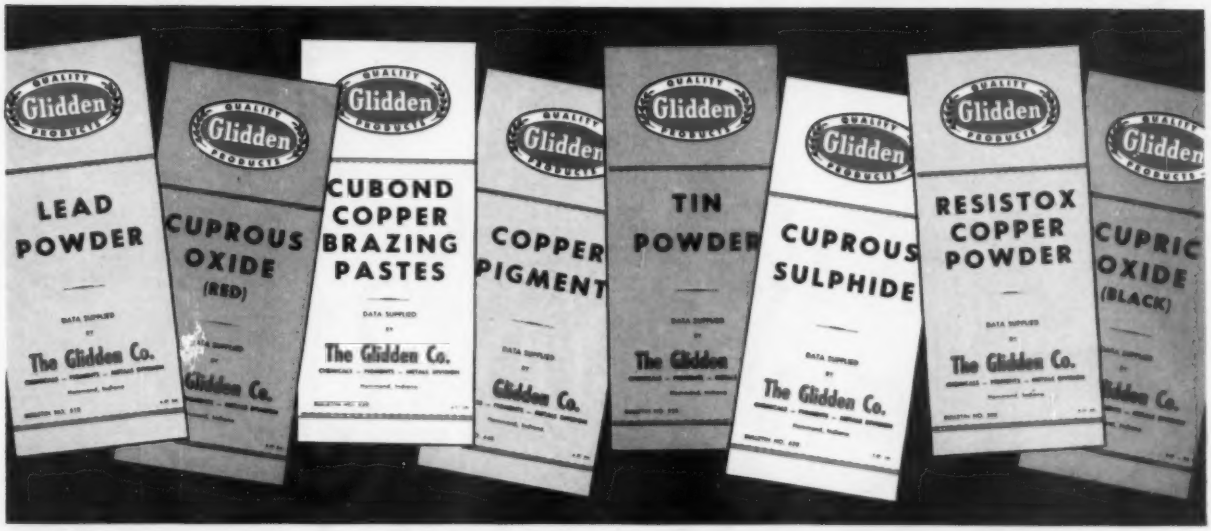

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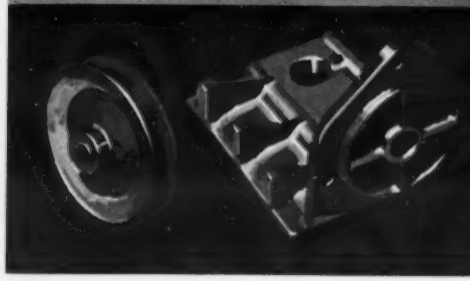

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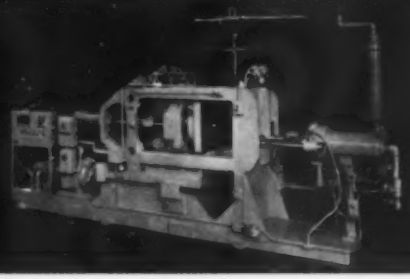

The theory in figuring the clamp required to hold an aluminum die casting is to multiply the plunger tip pressure by the projected area of the shot and then divide by 2000—that gives you the theoretical load in tons. Take the part shown above. With 105 sq. ins. of projected area and plunger tip pressure @ 11,000 p.s.i., the theoretical clamp required would be close to 600 tons. And some die casters would recommend more, perhaps 800 tons, to avoid "normal" blowback. That's theory. *The fact is, these parts run on a 400 ton Lester!*

How Come? Well, one point is that the molten metal is never an entirely hydraulic fluid, as theory supposes. But even more important is the fact that the Lester one-piece cast steel frame delivers every pound of its CERTIFIED locking tonnage to clamp the die evenly and solidly for the life of the machine. No blowback, no misalignment, no sagging, no adjustments.

The name "Electrolux" is known to millions of homemakers as an outstanding vacuum cleaner. The Electrolux Corporation of Old Greenwich, Connecticut, has built this recognition by producing and using high-quality precision made parts.

About two years ago, after a year of investigation, Electrolux decided to start manufacturing its own aluminum die castings. After inspecting a number of makes of die casting machines in various plants, they selected and purchased several Lester die casting machines. The new department has been producing precision castings from the start with good results from their Lester machines.

If you are looking for modern die casting equipment that delivers its rated clamp and capacity, to produce dense, flash-free parts—write for specifications on Lester Die Casting Machines.

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Cellulube 220 was chosen for this hydraulic press when it was installed at North American in 1956. At that time it was used for form-die quenching of hot, fully expanded titanium parts at 1000°F.

... and since 1959, this same press has been used to form brazed stainless steel "honeycomb" panels for the B-70 bomber. The panels are pressure-quenched at 1700°F. Cellulubes are still safely on the job.

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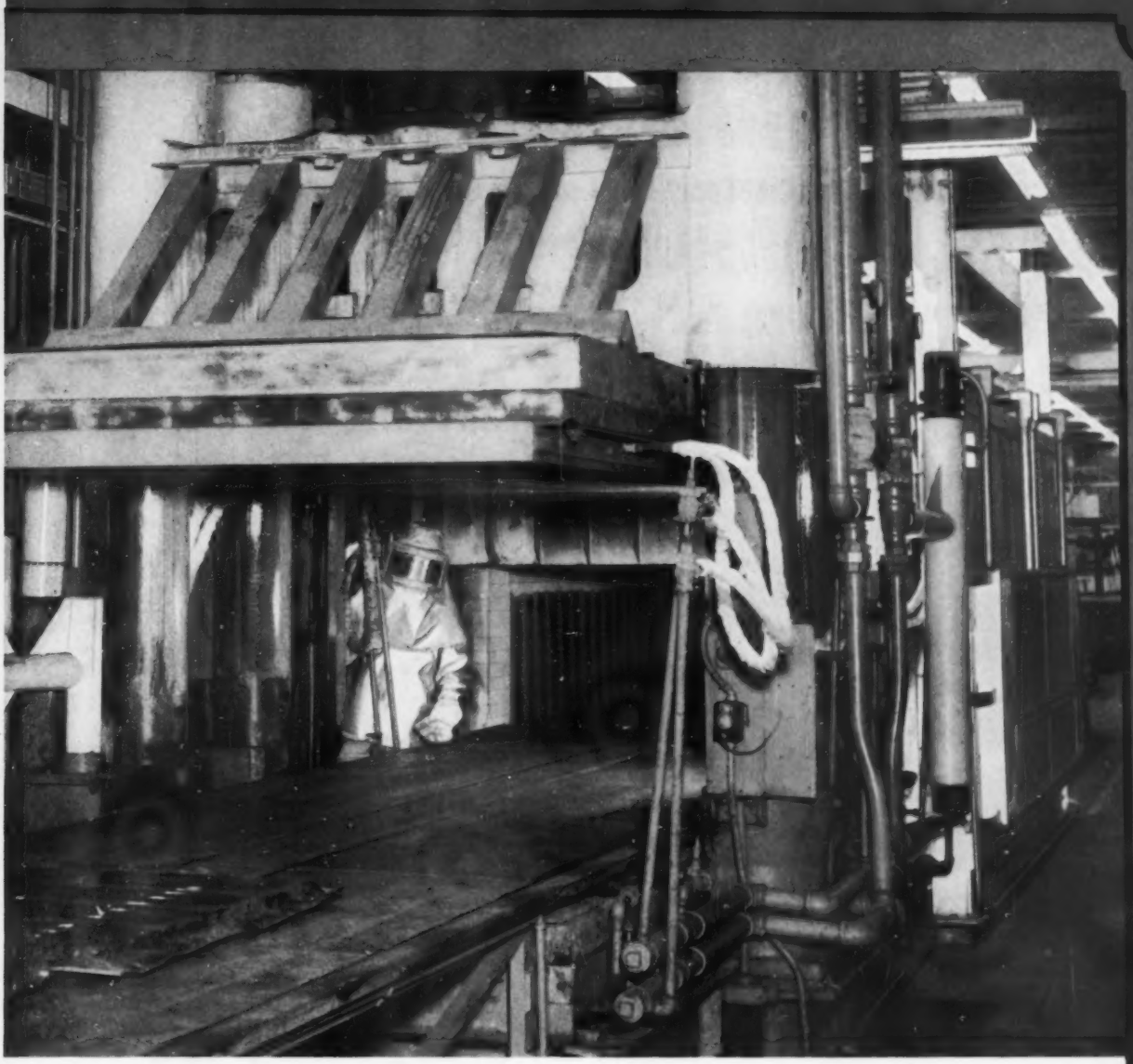

guard safety at North American

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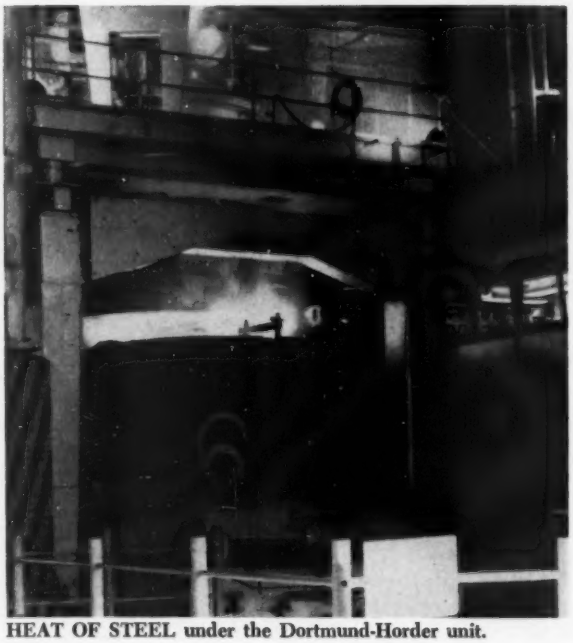
New Degassing Process Improves Quality of Steel



HEAT OF STEEL under the Dortmund-Horder unit.

The Crucible Steel Company has unveiled a new steel degassing unit at their Midland, Pa. plant. They claim the new unit, which uses the Dortmund-Horder Degassing process, is a major step toward providing much better quality steel at only a small increase in cost.

Vacuum degassing reduces nonmetallic inclusions and gas content in steel. This reduces discontinuities and voids in the ingot structure, providing improved transverse mechanical properties, more uniform properties from heat to heat, and narrows the quality band in a given melt.

The quality of the steel treated with the D-H unit is between that of vacuum arc melted steel and the normal electric furnace product. But quality is closer to the vacuum arc melted product while price is closer to the normal electric furnace steel.

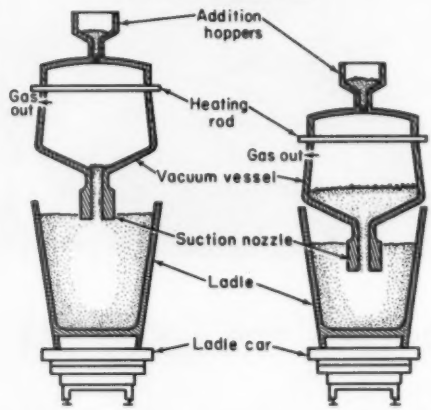
D-H processing reduces scatter in transverse ductility tests to roughly half that of normal air melted material. This improves reliability and permits designers to count more on full material strength.

Composition control, better than usual from open hearths, and perhaps even better than normal electric furnace practice, is another expected benefit.

The die casting industry and other users of hot work die steels are beginning to pay more attention to vacuum melted steel to get large blanks free from internal defects.

Crucible's D-H unit is the first in North America and the largest in the world. It was built by the Lectromelt Division of McGraw-Edison Company under license of Dortmund-Horder Huttenunion of West Germany. It has been in operation since last October.

How It Works



The D-H unit degasses steel by circulating the melt through a vacuum vessel. Only a small portion of the melt is exposed to the vacuum at a given time.

A ladle with molten metal is placed under a vacuum vessel. The vessel is lowered so that a suction nozzle is submerged beneath the surface of the melt.

Reducing the pressure in the vessel to 0.001 atmosphere draws a 59" head of molten metal up the suction nozzle into the vessel. Then the vessel is moved up and down. This causes about one-tenth of the melt to circulate in and out of the vessel with each up and down cycle. Thirty-two cycles makes an effective treatment for a 170-ton melt, exposing each part of the melt to the vacuum about three times.

After treatment, alloy additions are made from a hopper above the vacuum vessel. These additions are timed according to the solution rate of the alloy.

Six mixing cycles to promote homogeneity complete the treatment.

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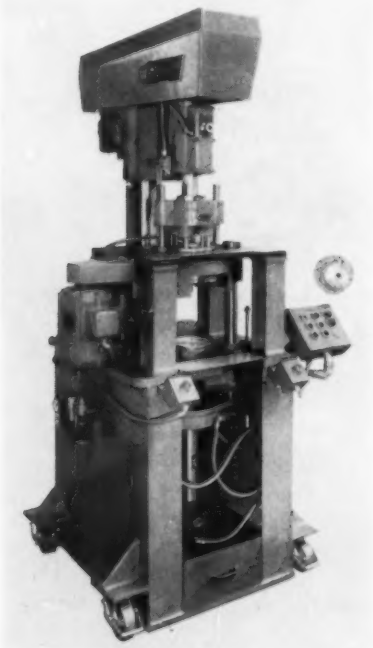
Face and tap a die casting in one operation

WISCONSIN DRILL HEAD CO.—A modified multi-tap machine performs several operations in one work cycle. The zinc die cast base in the machine has its rim faced, four mounting holes tapped, and



four leg-holes tapped in one cycle. The machine produces 1920 of these parts per eight hour day at 100% efficiency. The machine is safety engineered.

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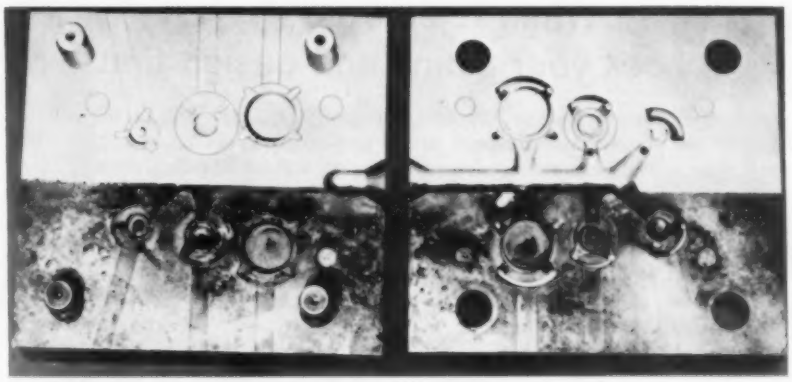
Die casting dies are pressure blast cleaned



PRESSURE BLAST MANUFACTURING CO.—A wet pressure blast unit and work handling device clean die casting dies. In the illustration, a male and female section weighing 265 lbs. each are shown in before and after (upper half) condition. The photograph is unretouched. On die casting dies the finish is said to provide an excellent lubrication retentive finish for longer die life and reduced break-in time.

The unit that did this job handles many types of large and small dies and other parts. This unit is in the form of a large cabinet. A roller attachment is available to load and unload the parts.

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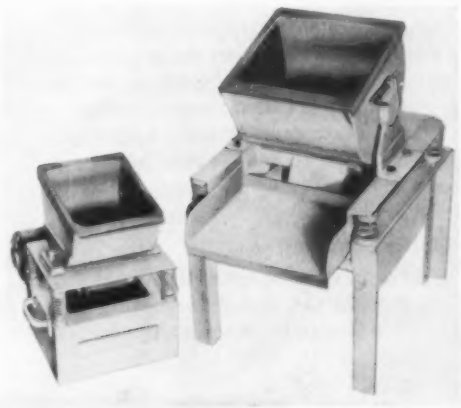
Deburr short-run quantities in your own shop



ULTRAMATIC EQUIPMENT CO.—Two small vibramatic deburring units make it possible for almost any shop to do its own finishing of short-run parts. The one-gallon model (left) is a bench machine and is easily portable. Neither unit requires anchoring to position. Motors are enclosed. The larger machine swivels and dumps into a receiving pan. The smaller one you just pick up, and dump. Both machines have totally enclosed motors and both will hold their rated capacity while operating.

Circle No. **237** on Reader Service Card

more New Products on page 50

REED-PRENTICE

DIE CASTING NEWSLETTER

When rejects go up... check your gating and design first.

Gating of die casting dies is perhaps one of the most misunderstood aspects of the industry. While some experienced engineers can come up with a very good gating system after studying a casting, too often gate patterns just seem to "happen that way."

The reason: gating's function is misunderstood and thus misapplied.

Because die casting is a high-speed, high-production process, it is generally deemed desirable to keep the connection between the runner and the casting as small as possible. This makes degating an easier operation, one requiring unskilled labor.

Fact... and fiction

While ease of degating is a definite consideration, the most important aspect of gating a die casting die is to provide a metered entry of the metal, preventing its entering the die faster than air can be vented. For vents must be limited in size to an area no greater than will freeze off without splitting.

Gates are often used to try to build up pressure on the metal, but this is a fallacy. Pressure build-up occurs *in the runner*. No matter what the conformation of the gate, pressure in the casting does not build up *until* terminal filling has occurred.

Pity the machine

As far as the effect on machine performance is concerned, gating design can—and often is—carried to a ridiculous extreme. Gates are choked off with no consideration of the velocity of the metal, volume of metal, time of fill, or any factor except that the operator must be able to break the gate off by hand... quickly and easily. The machine is expected to have high speed, substantial pressure, and *lots* of it.

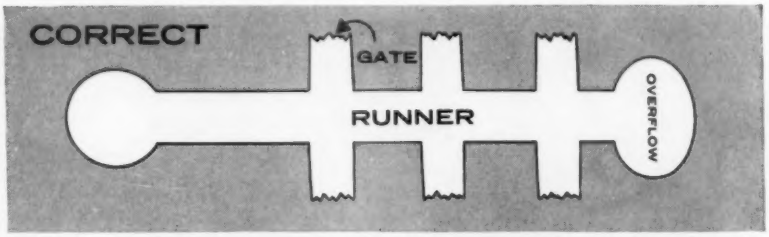
This is fine, but often it doesn't work. Too many castings have defects, rejects are up, and where do you place the blame? All too often, it's the machine's fault, or is it? Take another look at that gating design, and at the runners.

What runner pattern?

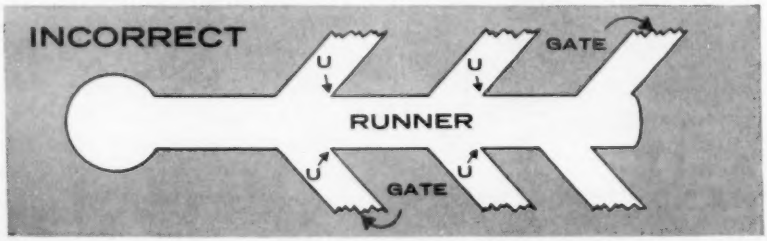
A runner is more than a means of conveying the metal to the gate. Consider it a high-pressure, smooth-walled conduit, with either a constant or reduced area that prevents expansion of the metal. Its size and conformation *are* important.

The simplified sketches here show a sound runner design and one other system which, though commonly used, tends to produce surface defects on castings.

If you are having casting trouble, why not check with your nearest REED-PRENTICE Sales Engineer. He'll be glad to consult with you.



With a straight runner, metal rushes to fill the overflow first, then the entire runner. It expands out from the center in a continuous flow, with equal force to both sides.



When a runner branches out at an angle, its upper edges (U) tend to catch a partial flow of metal. Small amounts are injected into the cavity before filling volume is available, causing a cold shot and rough, porous castings.

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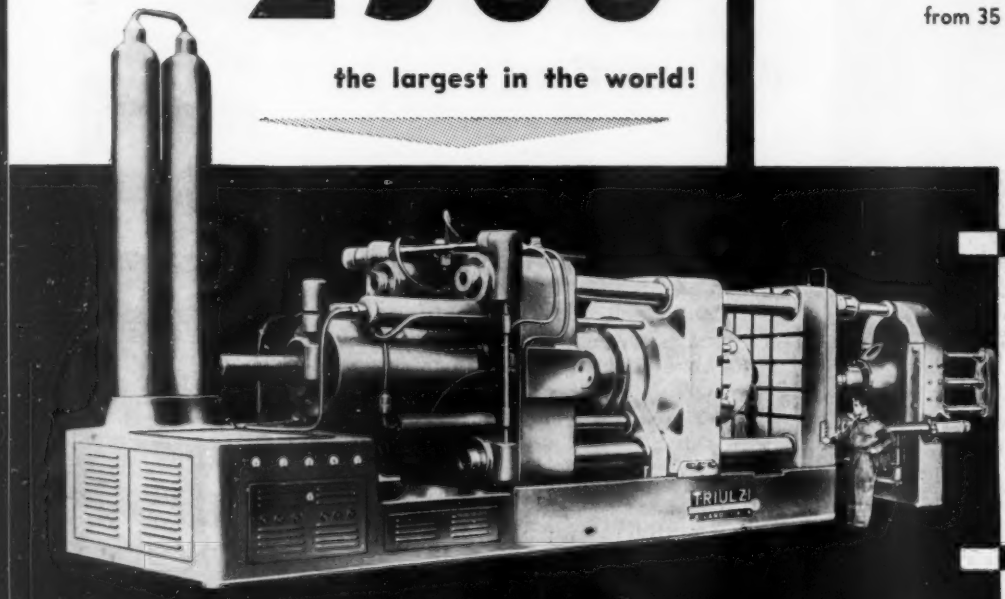

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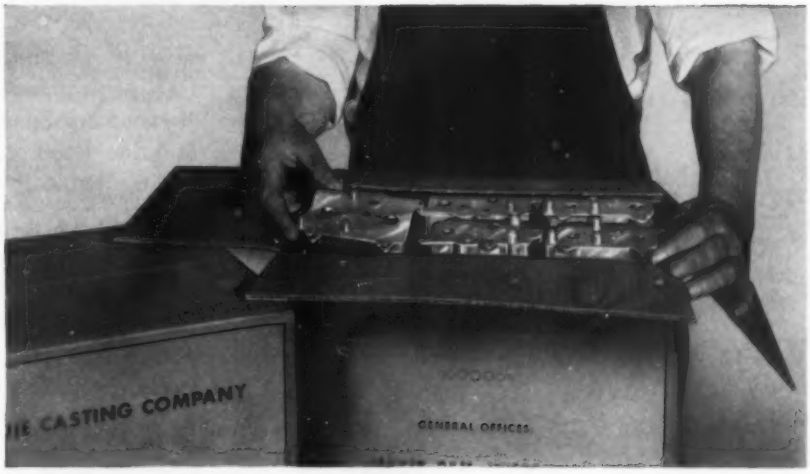
in your in-plant operations

(Chances for pick-up of Fe, Pb, Cd, etc.)

Despite your rules and practices, in spite of all precautions, in-plant good housekeeping is not always observed. Impurities, in harmful amounts, can get into your alloys.

Play it on the safe side—*start* with the zinc that's just a whisker away from five-9 purity...



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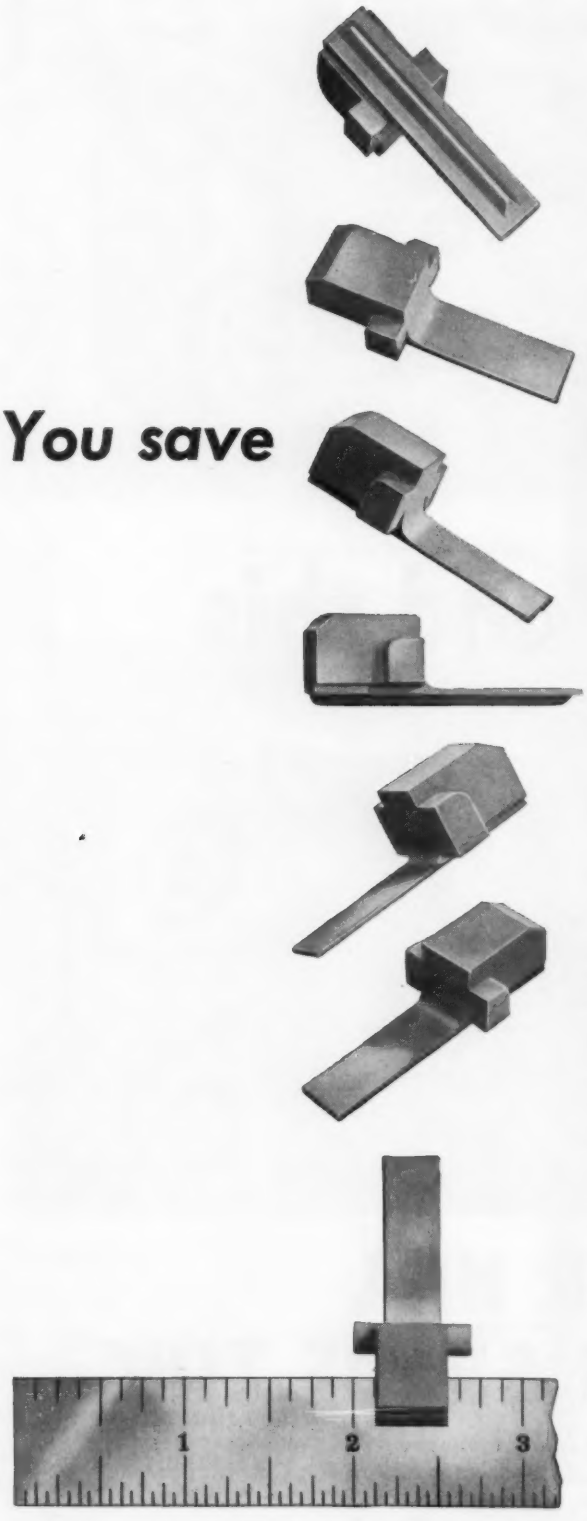

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news of industry & associations *activities of people, companies & groups in the precision metal molding industries*

promotions & changes

The New Jersey Zinc Co.—*Robert J. Kiechlin* was elected comptroller and succeeds *Edward E. Schwegler* who continues as a vice president of the company.

Hitchiner Manufacturing Co., Inc.—*Howard W. Johnson* has been elected to the Board of Directors.,

Misco Precision Casting Co.—*Charles Yaker* has been made vice president in charge of manufacturing at the Whitehall and Muskegon plants, and *Ajax Vartanian* has been made manager of the Muskegon plant.

Hanson-Van Winkle-Munning Co.—*Louis M. Hague* has been elected chairman of the board and chief executive officer. *Warren S. Wilkinson* has been elected president.

The Carborundum Co.—*Bruce Walker* has been named general manager of the Electro Minerals Division. *Dr. Donald W. Gillmore* succeeds Walker as manager of the division's technical branch. *Dr. Zachary D. Sheldon* has joined the company as associate director of the Research and Development Division. *Edward J. Finn, Jr.* has been promoted to manager of the Bonded Abrasives Division, Engineering Design Department.

Apex Smelting Co.—*Fred Schwarzkopf*, associated with the firm of White, Weld & Co., has been elected a director of Apex. Re-elected at the same meeting were: *William A. Singer*, chairman; *Louis Lippa*, president; *Fritz Nussbaum*, executive vice president; *William R. Bayer*, secretary-treasurer; *Gordon W. Reed*, chairman of the board, Texas Gulf Producing Co.; and *Hugh H. Wilson*, investor.

more on page 62

PRECISION CASTINGS COMPANY HOST TO VENDORS

OFFICERS of Precision Castings Co. (rear row) and representatives of the award winning companies.

"Thank you for helping us," was the theme of a luncheon given by the Precision Castings Co., a Div. of Precasco Corp., Monday, June 12. Representatives of 67 vendor companies attended.

Unique in vendor-buyer relations; this luncheon, the second that Precision Castings Co. has held, paid special tribute to twenty-five vendor companies that gave especially meritorious service during 1960. The twenty-five companies, according to Wm. Brammer, v.p.-marketing, ". . . helped us out beyond normal buyer-vendor relationships when we needed help."

The companies which received special awards are: **American Metal Co., Ltd.; Bechtel McLaughlin, Inc., Braeburn Alloy Steel Co., Cast Mold Co., Cleveland Corrugated, Duplex Mfg. & Foundry, Delta Model & Pattern Co., Keystone Box Co., Filstone Industries, A. P. Green Fire Brick Co., Jeavons Japanning Co., Micro Tool & Engineering, New Jersey Zinc Co., Rossborough Supply Co., Standard Glove Co., Time Steel Service, Inc., Wabash Smelting Co., White Tool & Supply, Zellner Foundry Co., Manufacturers Plating Co., Advance Plating Co., McNamara Motor Express, The Jayme Organization, Apex Smelting Co., and Alloys & Chemicals Corp.**

more Industry News on page 65

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Through investment casting, your metal parts can be made in a wide range of ferrous, nonferrous and super alloys. Results — better performance...longer life...lower costs!

This part for can making machinery now cast in a non-machinable alloy offers a very high degree of resistance to wear and corrosion. Results — costly parts replacement problems ended.

Better alloys often cost no more than the "inexpensive" ones when your part is an investment casting. What counts is *castability,* not machinability.

Write for complete technical and facilities information.

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PMM letters

the readers' forum

Porcelain enameled extrusions

I was quite interested in your article "Porcelain Enameled Aluminum Extrusions" which appeared in your May issue. This article referrs to two previous articles on the subject which you have published. These are "Vitreous Enamel for Aluminum Permanent Mold Castings" and "Porcelain Enameling on Aluminum."

I would appreciate very much if you would send me copies of these two articles.—H.P.G., Foundry Manager

Copies of the articles have been forwarded.—Ed.

Carbon-graphite parts

I read with interest the article in your April edition, "Carbon-Graphite Parts Improve Pump Design". I note that this concerns a pump manufactured by Procon Pump & Engineering Co.

It would be appreciated if you could give us the address of this company as we would like to get in touch with them.—MHP, Chairman

The Procon Pump & Engineering Company is located at 12721 Capitol Avenue, Oakpark, Michigan.—Ed.

Die casting application trends

We are searching for information regarding the increase over the last ten years of the use of decorative die castings in the appliance industry.

If you have any such information showing this trend, will you please send us a copy.

We also have a secondary interest in similar information for functional die castings.—R.L.S., Manufacturing Engineer

The names of several research organizations who study such trends have been forwarded.—Ed.

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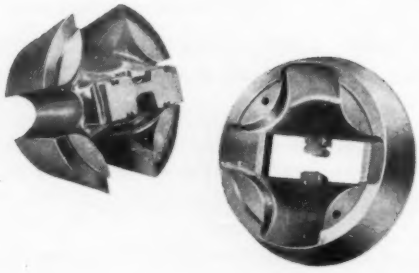
. . . experience makes the difference in

EXTRUSION DIES



It takes the right people behind the product to make a product of quality, and the extrusion dies manufactured by PMD are quality because behind their manufacture is the time-tested experience of specialists . . . PMD EXTRUSION ENGINEERS.

These specialists have not only the theoretical practice, but have on-the-job practical experience as well. They are skilled in every phase of extrusion dies, from design service to tooling function. From simple dies to the most complex dies. And remember, a PMD Extrusion Engineer is available to anyone having tooling problems. Call or write today.

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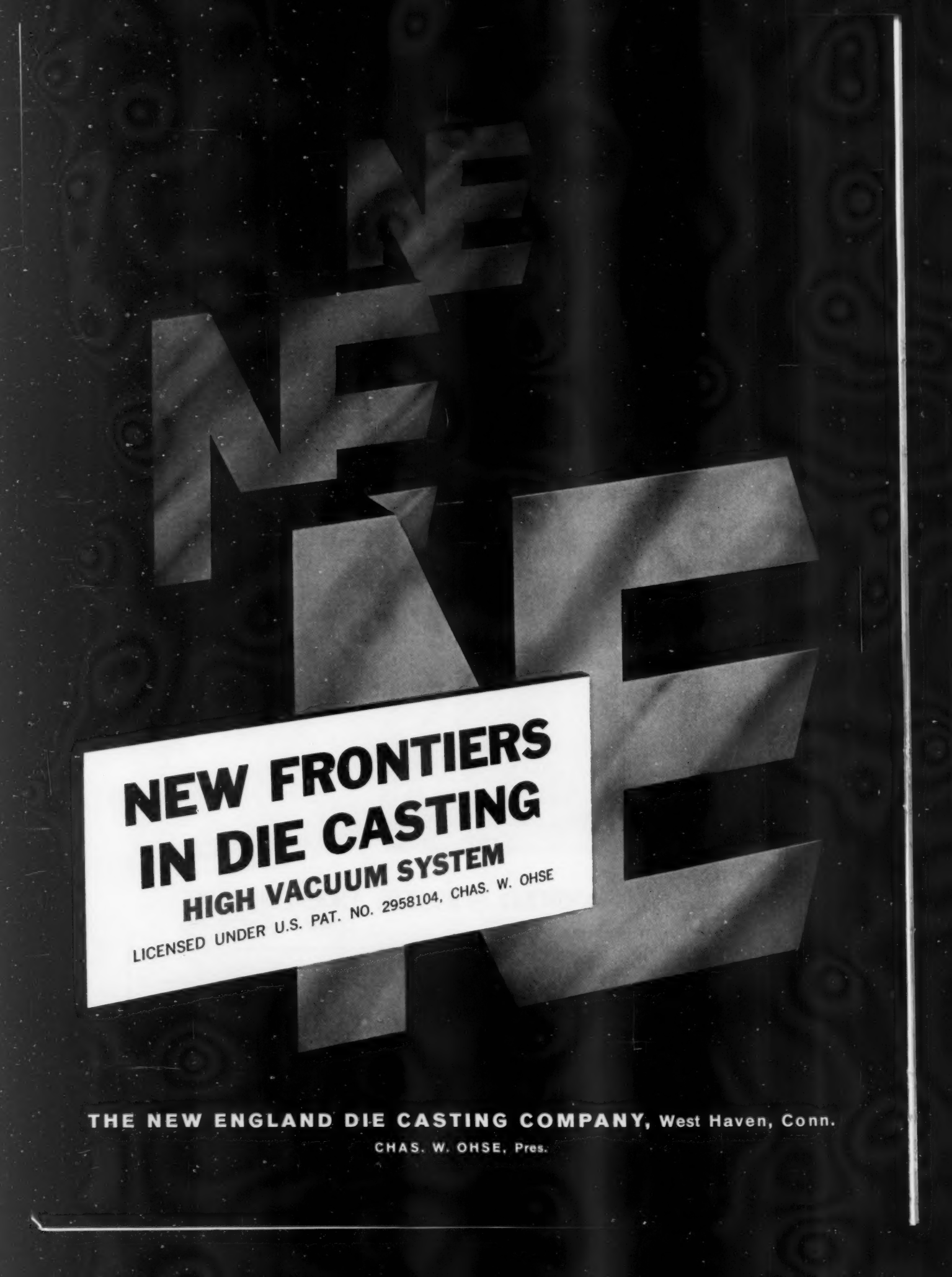
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NEW FRONTIERS
IN DIE CASTING
HIGH VACUUM SYSTEM
LICENSED UNDER U.S. PAT. NO. 2958104, CHAS. W. OHSE
THE NEW ENGLAND DIE CASTING COMPANY, West Haven, Conn.
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Precision
Metal Molding

JULY 1961

4. FUNCTIONALLY & MECHANICALLY adequate, this segment gear is less costly made by powder metallurgy.

DESIGNING FOR POWDER METALLURGY

By **T. L. ROBINSON**, *President, Powdercraft Corp.*

GEARS

This is the third in a series of articles by Mr. Robinson on the design of parts to be made from metal powders.

Segment gears

The segment gear shown in figure 4 is actuated by a rack and gives the oscillating motion to the gyrator on a wash machine. The advantage of powder metallurgy here is simply one of cost. The gear segment with bore and keyway is molded in a single operation. Gear cutting, milling, boring and broaching operations are all eliminated. The teeth have been thickened at the root to give adequate beam strength for this service.

Cluster gears

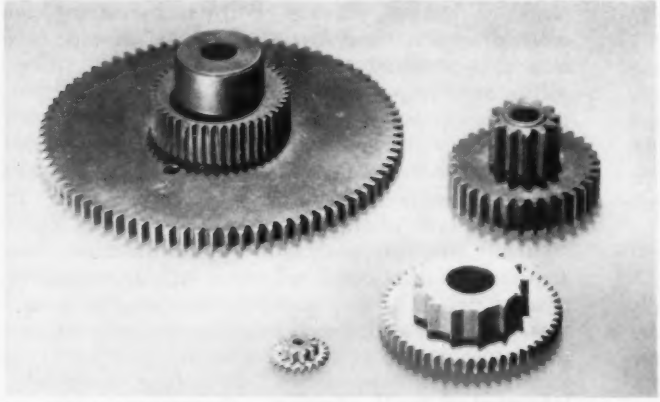
Cluster gears in a wide variety of types, styles, and sizes can be made by powder metallurgy. The gears shown in figure 5 are typical of these parts. Size limitations range from as small as can be handled to about 4" O.D. unless specially large pressing equipment is available. Note that one part is a combination of a gear and ratchet and another has a shoulder molded on to give adequate bearing length and self lubricating properties.

This point of self lubricating properties brings up another of the outstanding advantages of powder metallurgy for gear manufacture.

Bevel gears

Bevel gears are produced economically by powder metallurgical techniques. Within the load limits for which they are designed, they function with complete satisfaction. Like other types of gearing made by this process, bevel gears may give superior wear characteristics, run more quietly, and be dimensionally more uniform. Figure 6 shows a few typical bevel gears.

It is possible, with these gears, to modify the tooth form to gain increased beam strength and to



5. FOR A SLIGHTLY increased die cost, cluster gears can be made as easily as single gears.

6. MODIFIED TOOTH SHAPE, guarded teeth, and other features can be molded into beveled gears.

incorporate keyways, keys, and other non-round fastening devices.

One limitation is that usually the hub must be redesigned so that some mass of material is left under the teeth. This is seldom objectionable and in some instances can be used to include integral slots or chain devices to carry the load as against the usual method of relying on setscrews.

Combination of properties

Through the proper design of tooling and the selection of a correct powder mixture, it is possible to combine variable strength, density, and hardness in a single piece. Where a hard, wear-resistant tooth and bearing characteristics in the bore are required such a part is readily made. The teeth are pressed to a higher density than the center of the gear and a hardenable powder mixture is used. After molding and sintering, the teeth are induction hardened to get the strength and wear resistance desired. The entire gear is then oil impregnated to get self lubricating properties. In this way a separate bushing need not be used.

Combination of functions

The parts shown in figure 7 show how a pinion gear and a drive clutch can be combined. In this case the clutch drives a flywheel. Both parts are made from iron powder. In this part, hardness is important, especially on the teeth of the clutch. After hardening, both of these parts are oil impregnated to give the desired self-lubricating properties.

Internal teeth

When internal teeth are required they can be machined from wrought stock if the part is open on both sides. If, however, a blind part is needed, the internal teeth must be made as a separate ring and then fastened inside a machined housing. With powder metallurgy, however, these parts are easily molded as a single unit as shown in figure 8. Generally, costs are much lower than for a machined gear, and dimensional accuracy is better.

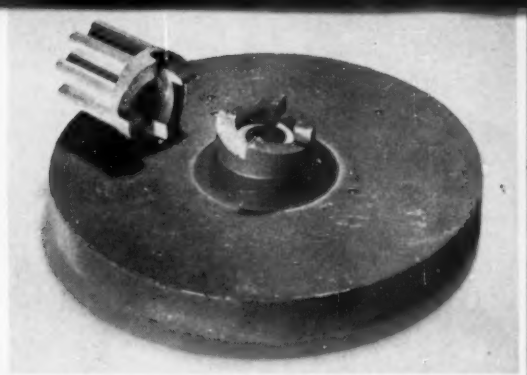
Special fastening devices

We have noted that either keys or keyways can be molded in a powder metallurgy gear. This saves broaching a keyway. When some other shape than a circular hole is required in a machined gear it can only be gotten by expensive machining.

The gears shown in figure 9 show three of the many possible special shapes which are as easily molded as a round hole. The one gear with a small keyway is exceptional. This is a blind keyway which extends into the hub only about ¼". Such a shape would be extremely expensive to machine. There's very little added cost when it's molded in.

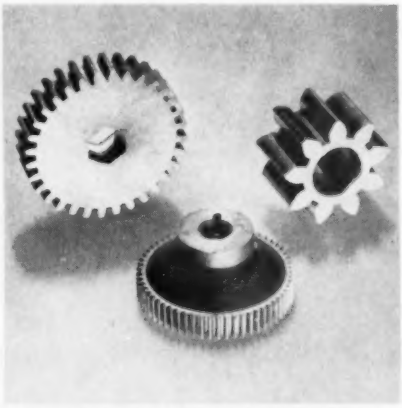
Special shapes

When gearing has to be combined with specially shaped parts, it is most frequently best to use powder metallurgy. The larger of the parts shown in figure 10 combines a pinion with a toothed indexing device. This would require either an assembly of two parts or a tremendous waste of material if made from wrought stock or a sand casting. Further, machining the toothed section on the cup would be an expensive milling operation.



7. A PINION AND DOG CLUTCH can be combined easily. Machining and assembly are avoided.

8. INTERNAL GEARING of this type would require machining two parts, and assembly by any other method.



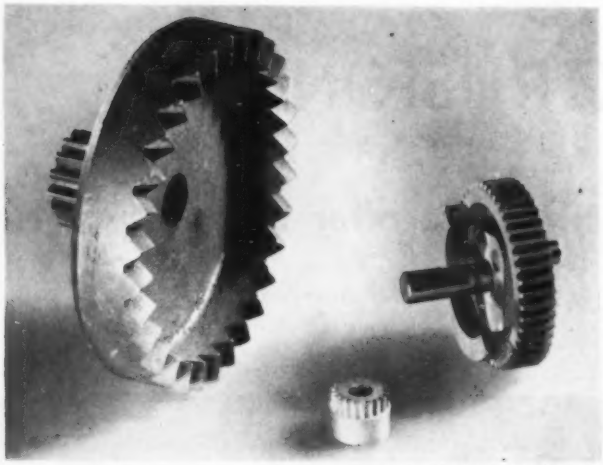
9. SPECIAL FASTENING DEVICES are easily molded into powdered metal gearing.

The smaller part shows how another special purpose gear is easily molded. Here we have a gear with an eccentric drive and a counter weight added to provide balance. Again, this part would have to be an assembly if made by any other manner. In this case, both shafts are pressed into cored holes.

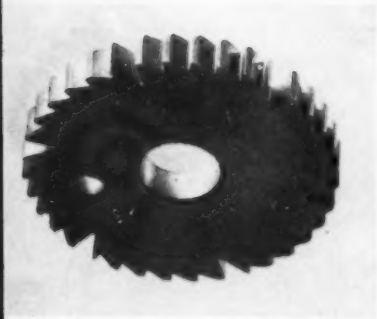
Finally, the tiny gear shown again illustrates how a part can be molded which would otherwise be a combination of two parts. In this case note also that a flat is provided to insure positive drive without the use of a key.

Interrupted tooth gearing

When, for special drives, interrupted tooth gear-

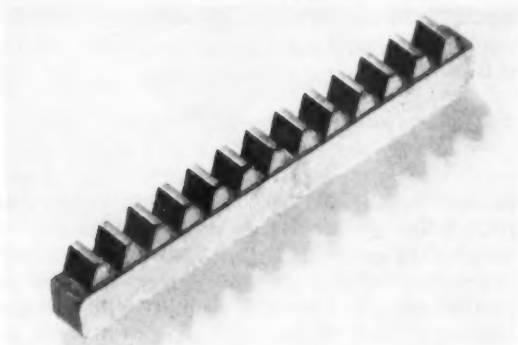


10. SPECIAL SHAPES COST no more than standard ones after the tooling has been made.



11. INTERRUPTED TOOTH gearing requires a separate milling operation. Powder metallurgy does it in one easy step.

12. RACKS are as easily made as any other powder metallurgy part. Wear and accuracy are good.



ing is required, it would normally be made by generating the gear in the usual manner and then the teeth which must be removed are cut out in a separate milling operation. Again, with powder metallurgy, the part is molded to the desired shape without second operations. Figure 11 shows this interrupted tooth design applied, in this case, to a ratchet.

Racks

There are many industrial applications for light duty racks and pinions. We have seen that pinions, like other gears, can be made quite readily. Racks, however, present a bit of a special problem. While the operating characteristics, tooth form, and self lubrication if desired can be secured by powder metallurgy techniques, there is a severe limitation on length. Generally racks must be less than 4" long. Where longer ones are needed they must be made in segments and joined as a second operation.

Within the size limitations, powder metallurgy racks have all of the advantages of other parts made by this process. The need to join segments together may, in some cases, be undesirable. Special locking devices can be formed during the molding operation to hold segments together. In these cases, it is essential that the designer consult a competent vendor before specifying a powdered metal part.

A typical rack segment is shown in figure 12. In this case, no special locking device is employed and with the shoulder in each end, this rack is not designed to be extended.

Testing gears

No really satisfactory method of testing gears other than a service test is available. Almost every company which makes gearing has a testing device of some sort which measures the breaking strength of the teeth. This is not a standard test, but is widely used as a production control method.

Wear resistance cannot be determined other than to put the gears into service and see how they hold up. Accelerated life tests are frequently used.

Special lubricating problems

Powder metallurgy gears, in common with many other parts made by this process, have the important advantage of self lubrication.

Especially in gearing, many applications exist where there is a tendency for the oil to drain away from the gears during idle periods. When this occurs, the gears run dry on start-up. This dry start causes excessive wear and requires a higher starting torque than would be the case if the oil supply were adequate. With oil impregnated gears there is never drain away of oil. The wear pattern is uniform.

There have been many cases, for example in the textile field, where large numbers of gear trains must be started simultaneously. Where the gears ran dry at the start, the added torque required an oversized motor. When proper operation was secured the motor would then run at only a fraction of its rated horsepower. Under these conditions an undesirable power factor would result with consequent power cost penalties. Powder metallurgy gears impregnated with oil reduced the starting torque so that a smaller motor could be used.

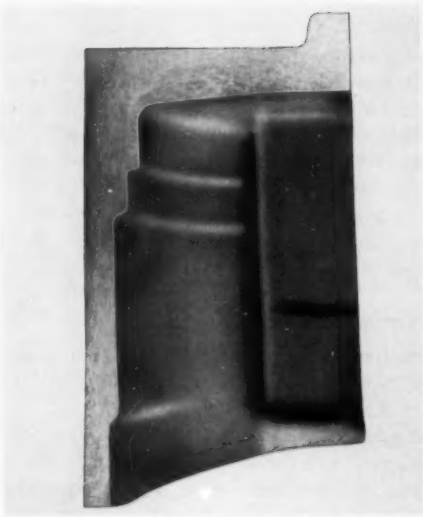
Another gearing problem solved by powder metallurgy was in a high altitude type of aircraft. A gear train had to be located where it could not be heated, nor could an enclosed gear box be used. Powder metallurgy gears, impregnated with special oil with a very low flow and pour point, were successful.

The gears illustrated and the examples cited are only a very few of the cases where gearing problems have been solved successfully by powder metallurgy.

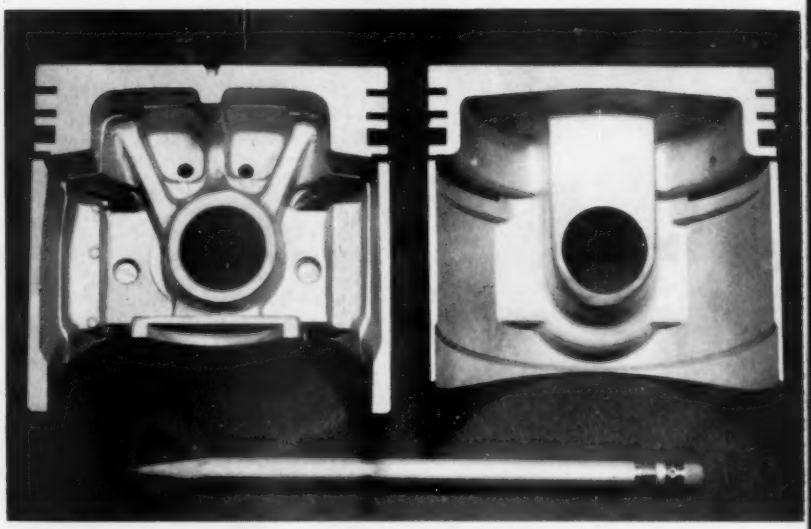
As long as the gearing is in the light to medium power transmission field, it's probable that powder metallurgy can give you a gear of adequate performance, and at a market reduction in manufacturing cost, as long as the quantities are sufficient to amortize the tooling and still show a cost reduction.

IMPACT EXTRUSIONS

. . . offer better properties



1. ALIGNMENT of the metal grain in an impact extrusion is evident when the part is etched. Note the continuity of grain flow around corners.



2. IMPACT EXTRUDED piston (right) and cast piston (left) can take the same loads, but the impact is lighter, has a simpler design.

IMPACT EXTRUSIONS are stronger than castings or forgings of the same alloy, shape, and weight. That's why an impact can provide more strength for the same weight, or the same strength for less weight. But—high strength is only one advantage of the impact extrusion process. Other desirable features are; smooth surface, close tolerance, and low costs.

Impacts get their improved strength from the way the metal flows during the impact extrusion process. As the metal flows through the die it aligns the fibers to conform to the part shape, as shown in figure 1. This alignment distributes the loads more evenly through the part for more efficient use of the material. It also improves ductility, resistance to fatigue, and thermal conductivity (See PMM, Aug. '60, p. 50 for a complete design guide for impact extrusions).

Lighter original designs

The Thompson Products Light Metals Division makes pistons for gasoline and diesel engines by the impact extrusion process. The pistons in figure 2 were designed to take the same loads. One is a permanent mold casting and the other is an impact extrusion.

The impact is just as strong as the casting, but higher material strength and better thermal conductivity permit the use of less metal. Therefore, the impact weighs 21% less than the casting. Also, note how the improved material properties permits a smoother, simpler design. Also, the ductility of the impact is superior to that of the casting.

Stronger replacement parts

Many of the pistons which Thompson makes are for the replacement market. Therefore, they must be the same weight as the original equipment to keep the engine in balance.

When Thompson designed an impact to replace a cast piston the impact was 25% stronger than the casting at the piston's 500°F operating temperature. The better thermal conductivity played an important part in this improved strength. The impact ran as much as 100° cooler in certain areas of the head, figure 3.

Less machining needed

Impact extruded pistons still need machining, but less material needs to be removed than with other

at lower costs

forming processes. These were the steps to a finished product for the impact in figure 2:

- **Impact extrude a slug of 12% silicon eutectic aluminum alloy.**
- **Turn the O.D. and cut the face to length.**
- **Grove and slot.**
- **Rough bore the pin hole.**
- **Grind the skirt.**
- **Tin plate.**
- **Finish bore the pin hole.**

Sometimes pistons require a complex contour on the head. For a cast or forged piston this usually means that a lot of machining is needed. However, by impacting, Thompson finds that they can usually get these contours with no secondary operations.

Not only does impacting produce better pistons, but Thompson Products also feels the process shows the most promise for long term competitive pricing. The process is easily automated and production rates are high. This helps keep costs low.

Design controls thermal expansion

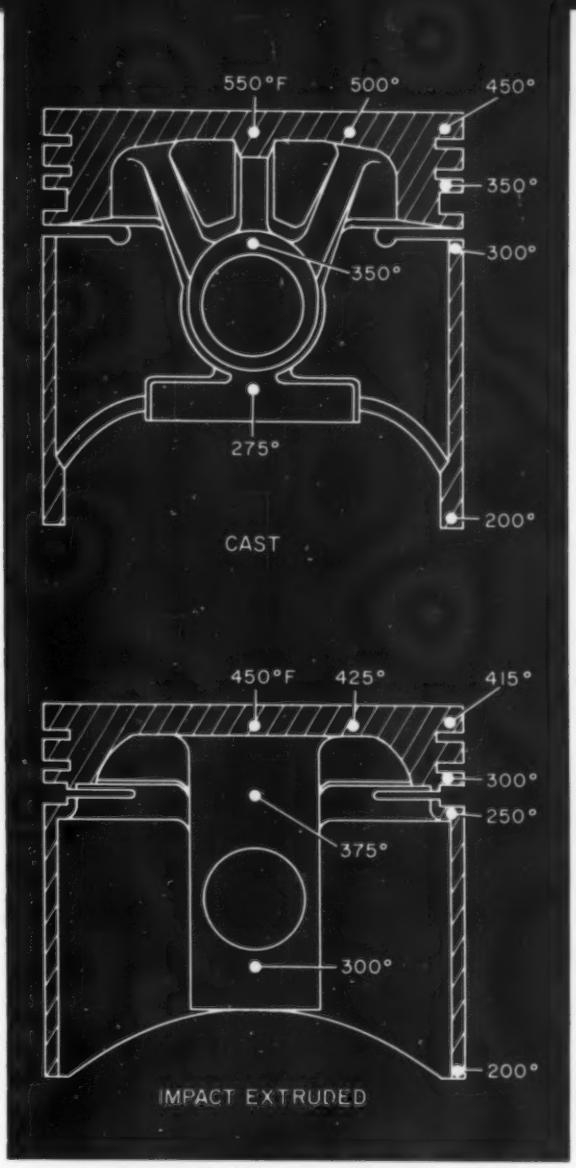
Steel inserts are used to control thermal expansion in cast aluminum pistons. Since inserts can't be used with impacts, Thompson's design engineers have slotted their pistons to control expansion. When the head expands, slots let it stretch the skirt along the pin bore axis. This causes a compensating contraction in the skirt on the thrust face axis. This control, coupled with the higher flexibility (elongation) of the impact, allows it to function without piston slap or without seizing and scuffing.

Less waste for pressure gland

An impact extrusion can cut costs even if the part must still be completely machined. The pressure gland for an airless sprayer shown in figure 4 was formerly made by machining away 51% of a bar of rolled aluminum. Now that it is machined from an impact, only 37% of the stock must be removed.

The impact also showed another important saving. Because alloys have their best strength when extruded, a lower cost material could be used and still have the same strength as the gland machined from rolled stock.

Using a lower cost material and having less waste, lowered material costs 67%. Labor costs were also lower. The break-even point for the two fabricating methods was only 350 units.



3. TEMPERATURE DISTRIBUTION comparison shows how an impacted piston head runs cooler than a cast piston head. These pistons were designed to weigh the same.

4. PRESSURE GLAND (right) formerly machined from rolled stock, costs much less when machined from impacted slug (left).

THIS IS GOOD DIE CASTING DESIGN

THIS EGG BEATER TELLS A STORY and it's a story that could never be told if it weren't for zinc die castings. Almost every good die casting design principle has been used. The result is a superior product which can sell at mass market prices. The beater was designed by and is made by the Ross Mfg. Co. of Chico, California.

At the start, all of the parts were made as zinc plaster mold castings. Actually all that this did was to prove out design because manufacturing by this method was far too expensive.

Now which of the good die casting design factors were used?

Most desirable shape—Neither the handle bracket or the yoke could have been made by any other process without excessive machining and assembly. As die cast they require only trimming.

Close dimensional tolerances—As cast and trimmed, the parts are ready for surface finishing. There's no drilling, reaming, boring, broaching, or other machine operations. Yet tolerances must be close or the gear drive will wear excessively.

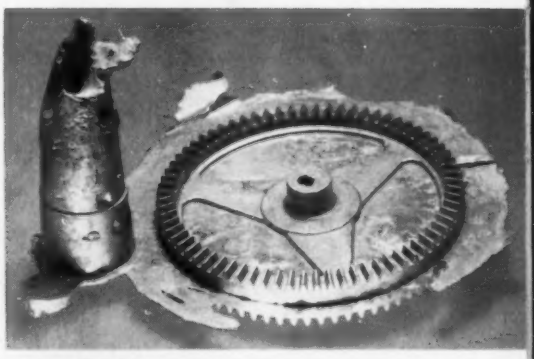
Assembly avoided—As an example take the yoke. The blind, nut retainer hole could not be made by normal machining methods. To get this particular shape would require machining two separate parts and then assembling them. This same condition is true of the bushings for the drive shaft. Here again only an assembly of several parts could be used if the piece were not die cast.

Accurately sized and positioned inserts—The brass tubing inserts which act as both assembly units and bushings are held firmly in place by casting the zinc around them. The inherent accuracy of the die casting process insures consistent angular accuracy and correct length of the insert exposed.

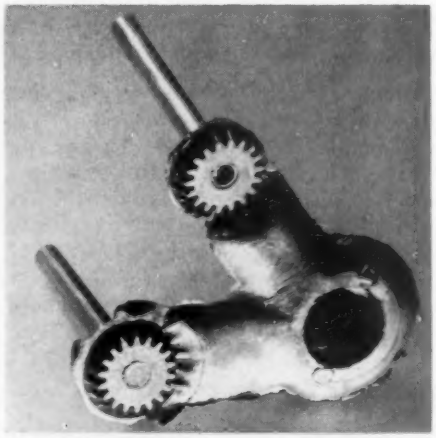
Low cost finishability—After trimming, a light polish to remove any trace of the parting line is all that is required. The castings are made with a sufficiently good surface so that they may be nickel plated with little or no buffing.

Simplified assembly—Because the parts are cast to close tolerances and because zinc is both ductile and acts as a good bearing material for low speed, light load shafts, assembly is fast and the inserts are accurately positioned. A steel shaft acts as the main drive shaft and has a flat milled surface on it. The double faced drive gear needs only staking to hold it in place.

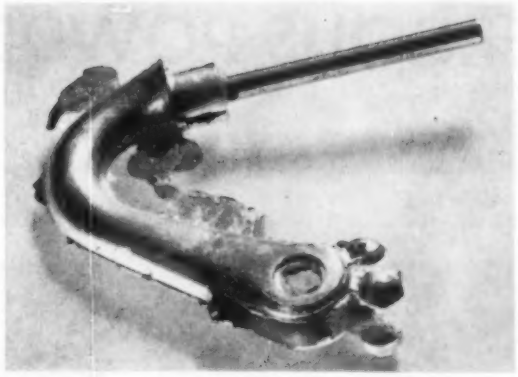
A feature of note is the use of a cast-in leg in the yoke. Without this leg there would be a strong tendency for this part to warp or twist during ejection and cooling. This avoids a straightening operation.



DOUBLE-FACED main drive gear is ready for finishing and assembly after casting and trimming.

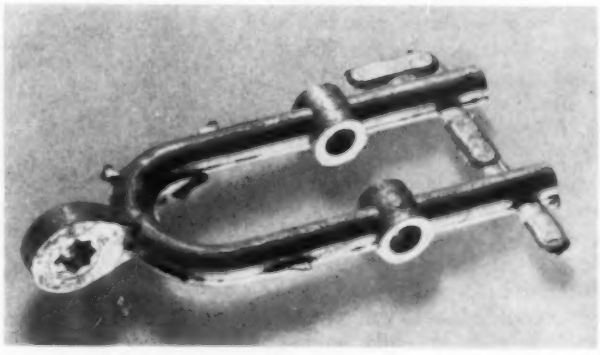


CAST BEVEL GEARS with brass inserts drive the beater blades.



COMPLETE REDESIGN of this handle would be required if the part were not die cast.

A CAST-IN insert makes handle construction simple and inexpensive. Only trimming is needed before surface finishing.

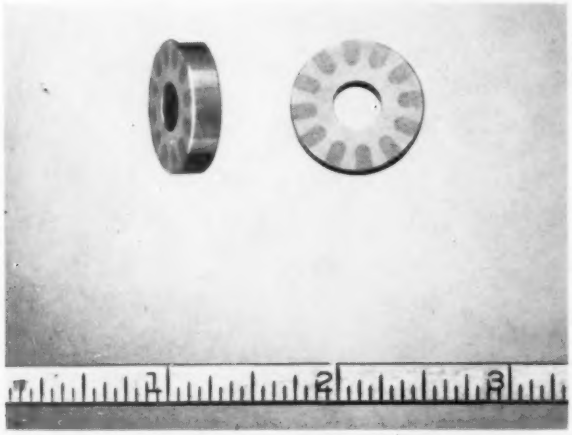


A TIE BAR across the legs of the yoke assures proper dimensional accuracy for assembly.

Light weight—For easy operation the egg beater should be light weight. Aluminum could not be used because a bright plated finish was required. But zinc is over twice as heavy as aluminum. To compensate for the difference, metal savers were used wherever possible. On the main gear, for example, the open design shown in the assembly was desired. To get proper metal flow and good ejection, a fairly solid part was necessary. The answer was to cast a thin section between the webs which would give the necessary metal flow and allow proper ejection. In trimming, this metal is easily removed to give the three spokes desired in the finished wheel. Heavier sections are cast under the ejection pads to give needed rigidity during ejection only.

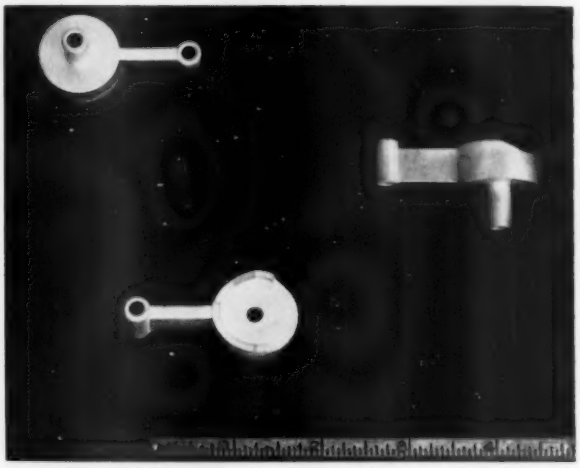
The several points brought out are only a few of the good die casting design features found in this durable egg beater.

NON-FERROUS POWDER METALLURGY



D. C. MOTOR ARMATURE produced by Kwikset Powdered Metal Products for the AiResearch Mfg. Div., The Garrett Corp. Made from metal powders the part represents a saving of 72% compared with the original method of production. The older method of manufacture (continued on page 68) . . .

AWARDS OF DISTINCTION



STRUCTURAL STRENGTH and self lubrication dictated the use of brass powder. Manufacturing economy dictated powder metallurgy for this phonograph motor toggle link. It's made for General Industries Co. by American Powdered Metals. The design provides a free floating (continued on page 68) . . .

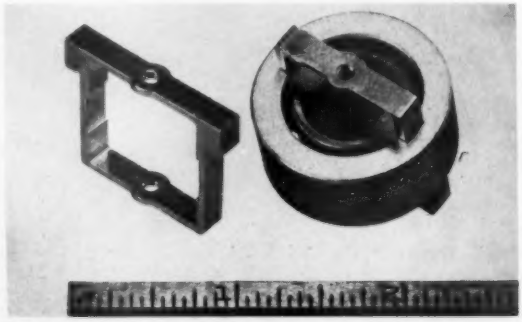
NON-FERROUS POWDER METALLURGY had, for a time at least, hit a plateau. The consumption of copper powder was at a moderately satisfactory level, but the rate of growth certainly had slowed down.

During the past two years, however, the annual competition sponsored by the New Jersey Zinc Co. has renewed interest in non-ferrous powder metallurgy.

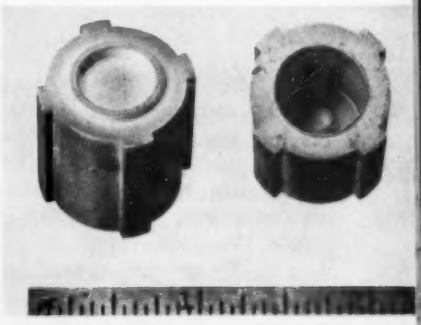
This competition is limited to new and sound engineering uses of brass, prealloyed bronze, and nickel silver powders. It has, however, quickened interest in the entire non-ferrous field.

This year's contest carried a single prize of $1000 equally divided between the design engineer, who conceived and developed the application, and the fabricator, who converted the ideas and drawings into compitent workable parts. As announced in the June issue (p. 42) of PRECISION METAL MOLDING, the prizes went to Walter F. Schuchard, chief engineer of the S. H. Couch Co. and Alexander L. Alves, president of Engineered Plastics, Inc. Their entry, a series of five gears for a fire alarm box, demonstrated almost every good engineering application of powder metallurgy.

But in addition to the single prize winner there were three awards of distinction and eight awards of merit. All eleven of these awards were won by parts which demonstrated the infinite adaptability of powder metallurgy, the cost saving possibilities of the process, and opened, in one way or another, fields in which design engineers can develop new applications.

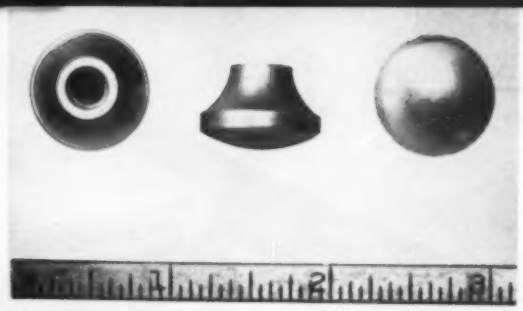


FRAME FOR CORE MAGNET—Designer Lawrence R. Burk, General Meters, Inc., fabricator Ferro Powdered Metals. Part must have high structural strength and be held to ultra close tolerances.

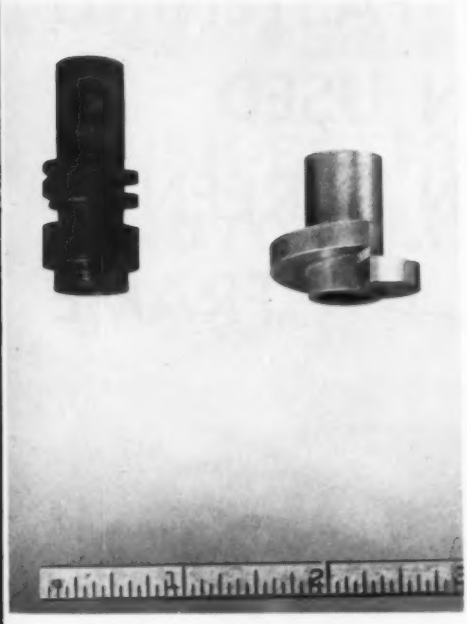


DISC HOLDER FOR REFRIGERATION SYSTEMS—Designed and manufactured by Mueller Brass Co. The part provides consistently close tolerances and reproducibility. Saving 40% compared to machining.

AWARDS



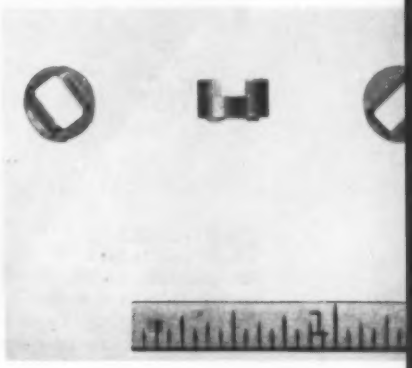
LIFT KNOB—Designer Robert E. Peterson, Union Brass & Metal Mfg. Co., fabricator Midwest Sintered Products Corp. Replacement of a screw machine product at a 20% cost saving. Now is crown buffed and plated.



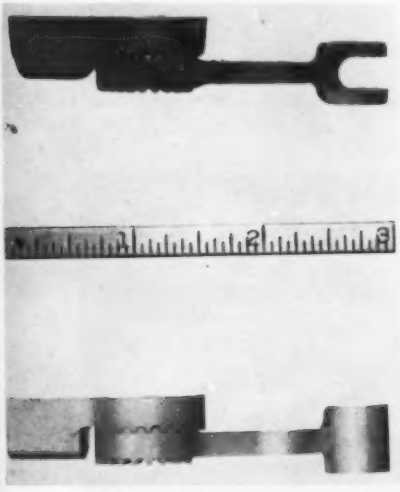
BETTER PIN-SPOTTERS are possible because of this brass powder part made for American Machine & Foundry by International Powder Metallurgy Co.

The improved design (right) could be machined from steel as was the original

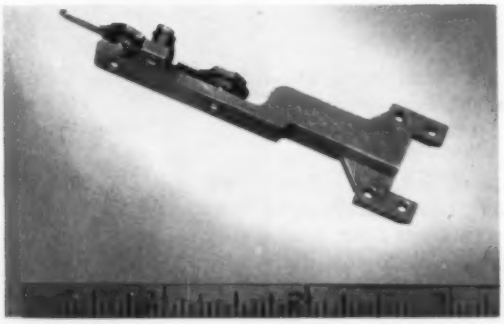
(continued on page 68)



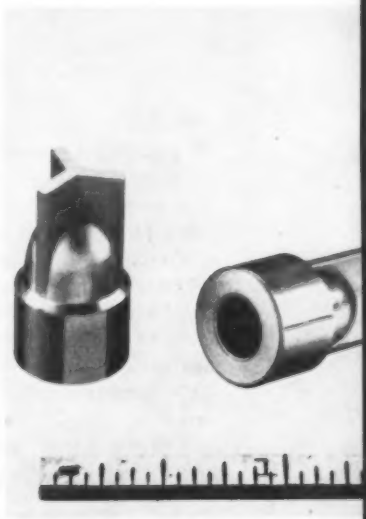
SLEEVE FOR TOGGLE SWITCH—Designer P. F. Hohmann, Microdot, Inc., fabricator Pacific Sintered Metals Co. Previously machined from brass bar stock. Now made of brass powder at 93% saving. O.D. must be held to ±0.005.



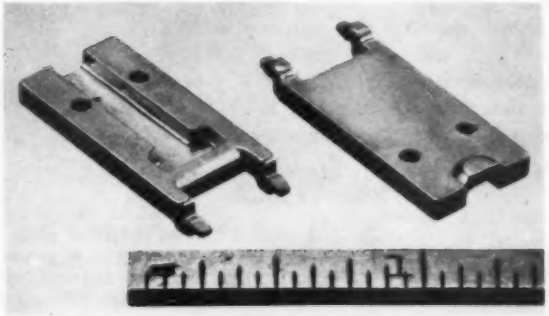
ARMS FOR MULTI-PURPOSE FLOAT VALVE—Designer W. Naughton and B. Heindricks, Robert Mfg. Corp., fabricator Kwikset Powdered Metal Products. Powder metallurgy showed a 15% cost saving, gave improved design, better adjustability.



FLOW METER LEVER—Designers P. K. Tracy, L. N. Hatch, N. S. Graves, The Foxboro Co., fabricator Engineered Plastics, Inc. Part showed improved accuracy, better corrosion resistance and 72% saving over older part.



THREE-WAY VALVE PLUG—Designer Wesley Moline, Barber-Colman Co., fabricator Metal Powder Products, Inc. Redesign of an assembly of four parts at a saving of 47%.



HEAT SHUNT—Designer Howard Needham, North American Aviation, fabricator Kwikset Powdered Metal Products. Part is prealloyed bronze and is chromium plated. A 95% cost saving with satisfactory heat conductivity resulted.

SELF-FASTENING EXTRUSION USED FOR SUN SCREEN FRAME

RIGHT-ANGLE corner post holds two extrusions together because the saw-tooth edges are slightly larger than the extrusion openings.

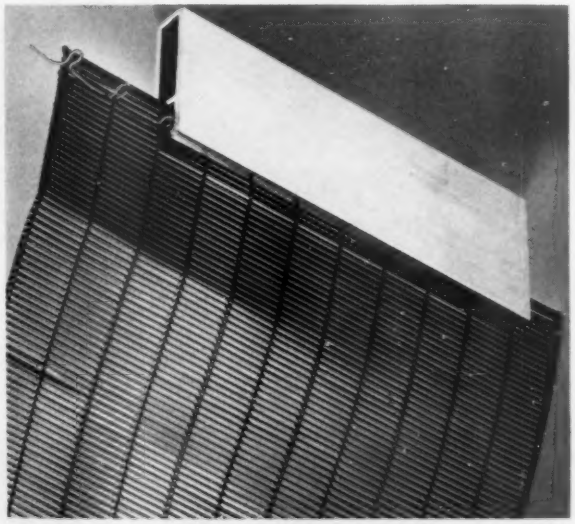
THREE EXTRUSIONS form an interference fit at the corners of Borg-Warner's KoolShade sun screen. This interference fit holds the screen together, and no other fasteners are needed.

KoolShade is a solar screen, installed outside the windows, which keeps direct heat and glare of the sun from entering buildings, but does not hinder the view of occupants looking out. To do this the KoolShade uses a screen woven from flat bronze wire. This woven screen resembles a miniature venetian blind.

Extrusions are used for the frame primarily because they look good and blend with present architectural trends, but their durability and ease of assembly are added benefits. The rolled aluminum and steel frames formerly used were difficult to handle and assemble.

At the corners of the frame the top or bottom rails butt up against the side rails with a 45° mitred joint. An extruded corner post with 0.012" oversize saw-tooth edges fits inside the rails. As the post is pushed into the rails, the edges of the teeth are distorted slightly to form an interference fit. This fit is tight enough to give rigidity, yet permit easy disassembly if the screen has to be repaired.

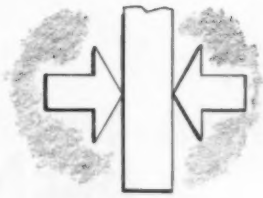
A channel on the inside of the extrusion holds an extruded vinyl strip and a wire clip which holds the woven screen. The woven screen is stretched 0.1 foot per lineal foot so that it remains taut in the assembled screen. The extrusions are made from 6063-T6 aluminum and are anodized.



INCREASING the angle of incidence decreases the amount of solar heat and glare which pass through the sun screen. No sunrays pass at angles over 40°. Vinyl strip has been removed from the extrusion to show how a wire clip keeps the screen from slipping from its position.

FAST!

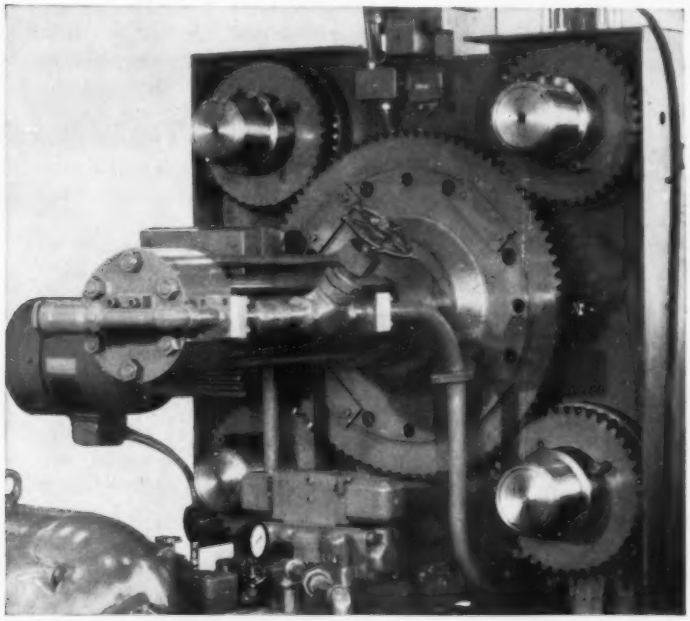
ACCURATE!



STABLE!

EFFORTLESS!

PUSH-BUTTON DIE HEIGHT ADJUSTMENT AND TONNAGE CONTROL... *a valuable operating advantage of Greenlee - B & T Die Casting Machines*



At the touch of a button you can now get die height adjustment for set-up and tonnage control. The Greenlee-B & T system uses a gear-head electric motor to drive a large bull gear which in turn drives a pinion gear on each tie bar nut.

This system maintains . . .

(1) inherent rigidity of our clamp by equal loading of each tie bar and set of four corner links.

(2) large bumper bar pattern, both vertical and horizontal, because there is no central screw interference.

(3) large range of die height adjustment normally available with tie bar nut machines without sacrificing individual nut adjustment.

(4) accessibility of hydraulic ejector mechanism.

Greenlee-B & T motorized die height adjustment permits the flexibility of other designs. In addition it provides easier control and adjustment without sacrificing rigidity. Write for complete information.

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BLENDING METAL POWDERS

By **JOHN J. FISCHER,**
Chief Engineer,
Process Equipment Div.,
The Patterson-Kelley Co.

BLENDING IS ACHIEVED by creating a flow pattern which encourages divergent flow of the particles to achieve a consistent random distribution. Metal powders, due to their high density, can be blended effectively in the proper equipment.

The most widely used types of blenders are twin shell or double cone designs. They require far less power due to the rolling action given the charge. Another advantage is the much lower abrasive wear. In contrast, a blender which must push the powder around to get flow, requires ten times as much power, and the abrasive wear on the equipment is greater.

In powder metallurgy, we are normally working with a broad range of particle sizes. Usually, an appreciable amount of the mixture consists of very fine particles. These very fine particles can tend to dust out and remain suspended in the air in the blender. When rotation is stopped this dust will settle out on top of the larger particles, this will cause segregation rather than mixing. If the fine particles happen to be a minor constituent of the mix, this segregation can effect the mix seriously.

One solution to this problem is to slow down the speed of the blender. This will prevent dusting, but tends to give poorer mixing due to improper flow at the trunions. This can be partially overcome by decreasing the charge from the recommended 65% of the total volume to less than 50%. This keeps the charge below the center of rotation and insures complete displacement and turnover.

Over-blending is another problem. In some cases actual segregation occurs instead of mixing. The precise cause of this has not been learned, but there is evidence that the constant rubbing of particles on each other builds up a static charge on the particles. As a result the fines are attracted to the walls of the blender. This layer is constantly wiped off by the flowing powder and can cause serious segregation. The cure is usually a shorter blending time.

Metal powders blend very rapidly, usually in 5 to 10 minutes. Longer times can cause segregation.

Some powders, because of poor flow characteristics or wide differences in densities, should be granulated before pressing. Tungsten carbide mixed with another powder is a good example of this. The best procedure for such a mix is to agitate dry for a short time to get a uniform blend. Wax, suspended in some liquid such as carbon tetrachloride, is then added while the mixer is rotating. By proper control of the amount of liquid and the blending time, the degree of granulation desired can be gotten. After granulation, the liquid is evaporated.

When powders will not granulate during liquid addition they may do so during the drying cycle. For this type of work a mixer which can operate at below atmospheric pressure inside is needed.

Usually, double cone blenders are not adequate for the different jobs which may come up in a jobbing powder metallurgy plant. Special blenders have been designed to handle practically all types of mixing, blending, and granulating.

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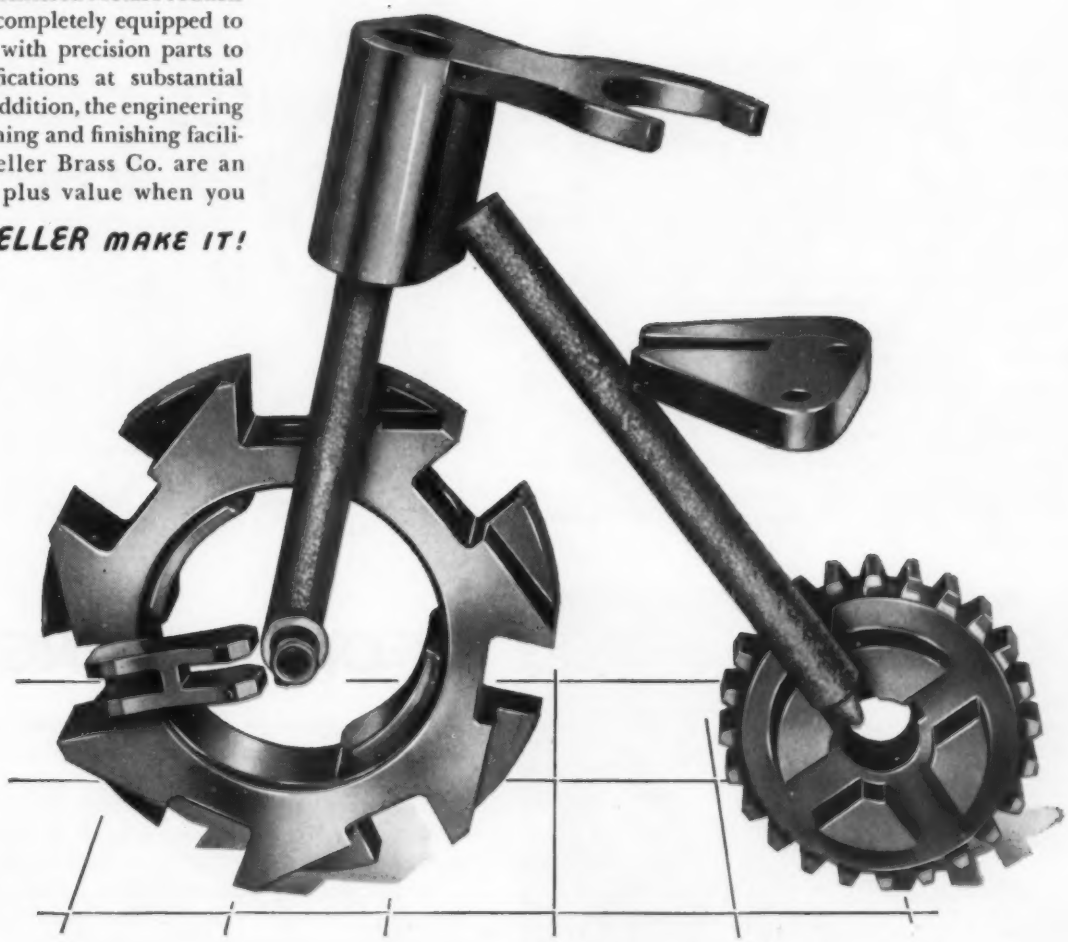

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INVESTMENT CASTING REPLACES MACHINED PART

This cast power shaft, which controls the shutter speed and timing mechanism on a 35 mm camera, is one of the latest examples of the Minicast process, a precision forming process developed by Casting Engineers.

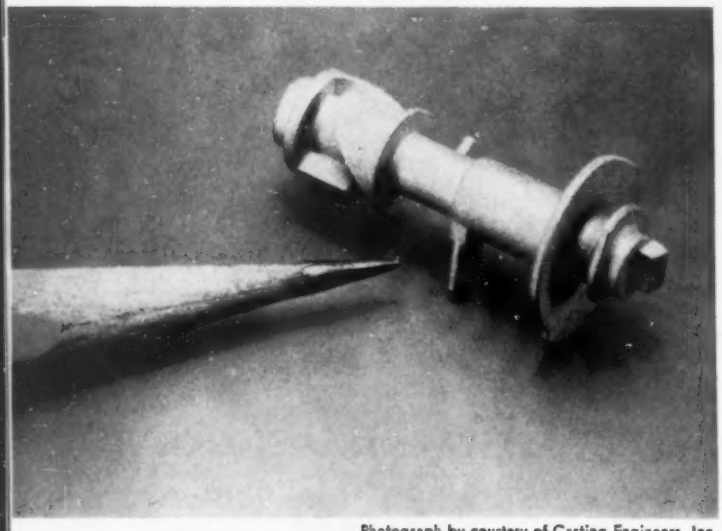
The part was formerly made on an automatic screw machine with extensive milling and other secondary operations required.

Today, it is Minicast in a tough chrome-nickel-moly steel, at less than one-third the original cost.

This cost saving was partially realized because the Minicast process was able to hold, as a primary operation, tolerances ranging from plus or minus .002 to .005 maximum, particularly important in the difficult-to-machine cam areas.

Now, the only required secondary operations are simple drilling and teeth shaving operations.

More than 150,000 of these parts have been Minicast to date.



Photograph by courtesy of Casting Engineers, Inc.

Photograph by courtesy of Casting Engineers, Inc.

VARIABLE THICKNESS IS NO PROBLEM

This component is used on the extractor mechanism of a rifle. It is cast in 4140 steel, then subsequently heat treated to a spring temper.

Of particular interest are its varying cross sections which range to a low of .032" (particularly difficult to cast in steel).

Due to its configuration, the part tends to warp, yet investment casting makes it possible to hold tolerances between the center point and each end to a total variation of only .006".

ONE CASTING, NOT

Alert design engineers and purchasing agents are always searching for a means to buy a single part, in lieu of two or more components requiring assembly at additional cost.

A case in point: this part is used as an automatic coin changing mechanism on a vending machine.

It was formerly composed of a series of separate stampings and other fabrications that were subsequently brazed together.

Today, this part is produced as a single unit by the Minicast process.

For maximum corrosion resistance, and ease of casting, 303 stainless is used. This alloy also eliminates the need for plating.

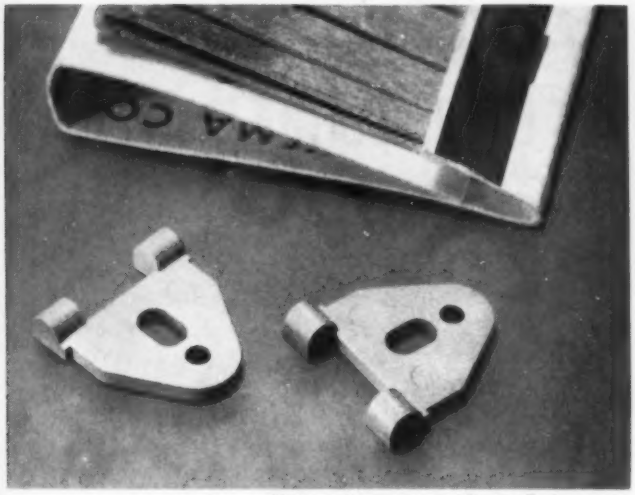
As a one-piece Minicast part, multiple production and assembly operations have been eliminated, and strengthening ribs and more desirable contours, not practical by previous production methods, have been incorporated in the part without increasing its cost.

GOOD WEAR AND CONDUCTIVITY WITH BERYLLIUM COPPER

This yoke is an electrical relay system component cast in beryllium copper 20-C. This particular alloy has electrical and abrasion characteristics which have proven to be superior to the original materials used.

It should be noted that the tool legs are held with a total variation and tolerance of only .005".

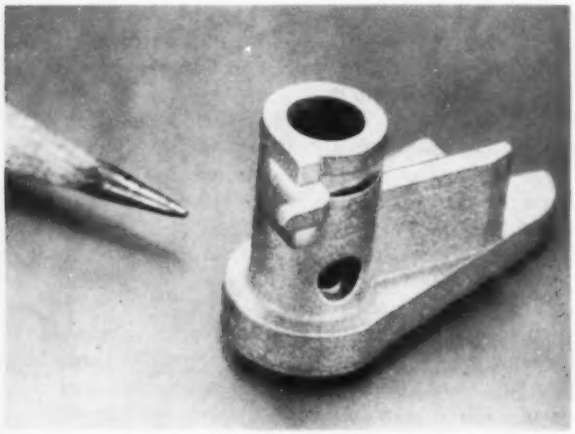
Cast beryllium copper alloys often maintain the electrical characteristics but have the added advantage of hardenability for wear resistance.



Photograph by courtesy of Casting Engineers, Inc.

MULTIPLE STAMPINGS

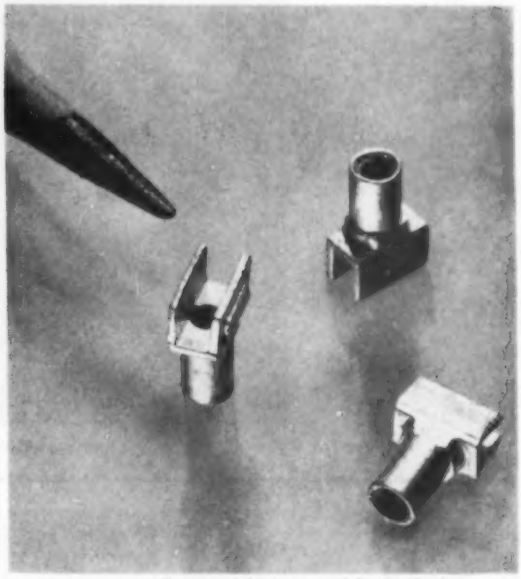
Also, surface finish is maintained at better than 45 micro-inches by barrel tumbling.



Photograph by courtesy of Casting Engineers, Inc.

TOO FRAGILE, TOO SMALL, TOO INTRICATE

. . . try investment casting



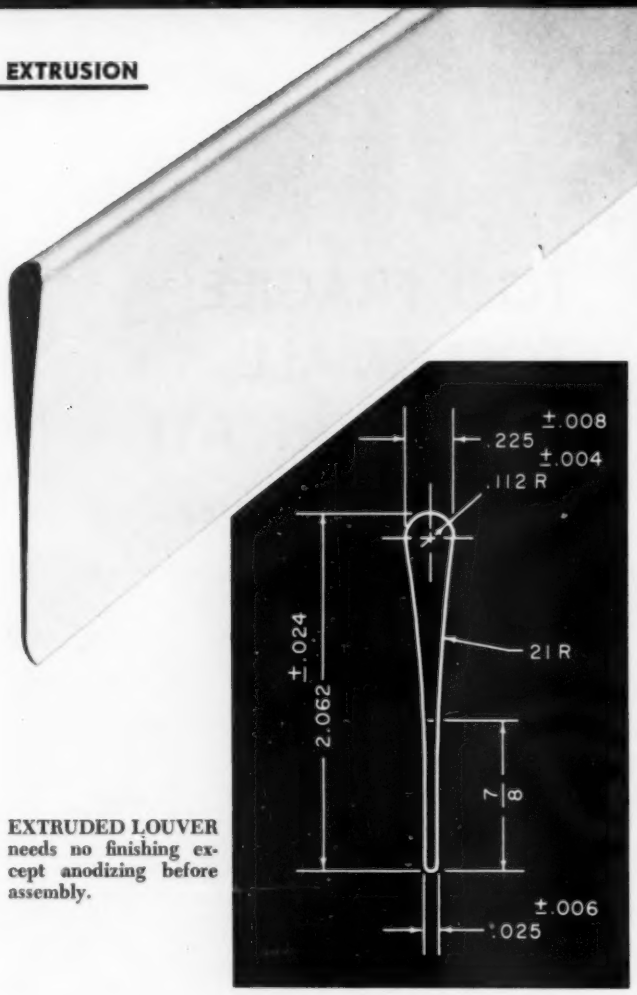
Photograph by courtesy of Casting Engineers, Inc.

This part is a drive shaft used on a high fidelity tone arm component.

It is investment cast of 356 aluminum, required because minimum weight is a must in the delicate balancing of the tone arm.

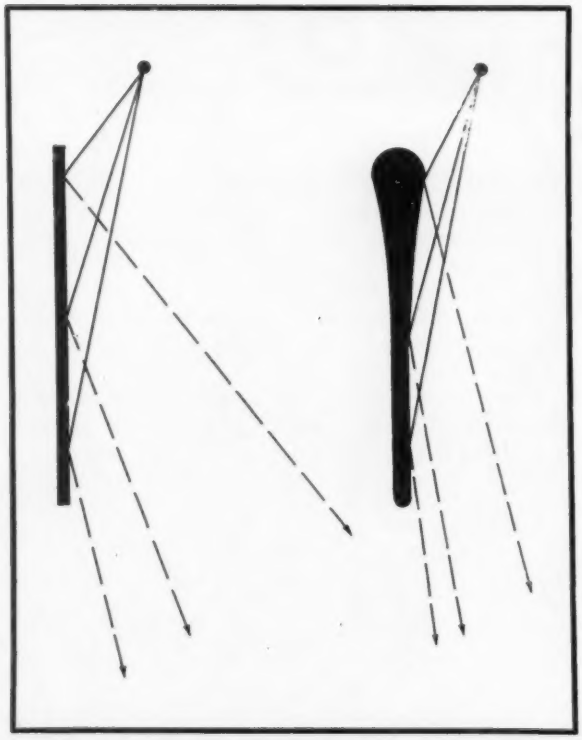
Reasons for investment casting: too small for die casting, too fragile for forging, too intricate for economical machining.

This part represents one of the world's smallest aluminum investment castings, with wall sections only .032" thick.



EXTRUDED LOUVER needs no finishing except anodizing before assembly.

BETTER LIGHTING WITH EXTRUDED LOUVERS



PARABOLIC SURFACE of extruded louver focuses light rays downward, keeping them from scattering. Flat surface reflects light rays at divergent angles.

ORDINARY SHEET METAL LOUVERS in ceiling lighting fixtures leave much to be desired. Although they're supposed to direct light downward where it's needed, these louvers permit too much light to scatter horizontally. This scattered light causes glare and discomfort, for instance, in busy offices.

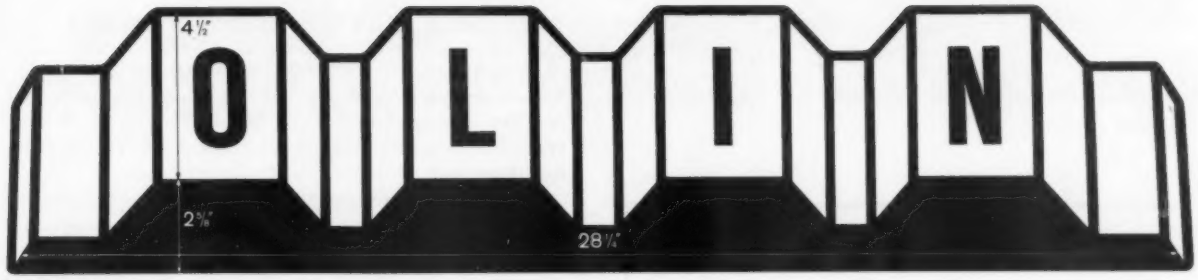
Designers at Curtis-AllBrite Lighting, Inc. decided that the way to solve this problem was to focus the light instead of just reflecting it. That's why they turned to extruded louvers for their recessed fluorescent lighting fixtures (called troffers by the trade). To focus light downward they had to reflect it off of a parabolic louver. The easiest and most economical way to provide a parabolic surface on the louvers was to design them as extrusions.

Precision Extrusions, who makes the louvers, recommended that they be extruded in 6063-T5 aluminum alloy because of its good extruding and anodizing characteristics. Also, this alloy provides the smooth surface required.

After the louvers are extruded, they are cut to length, notched, and anodized. They are brightened during anodizing to increase reflectivity.

Tests made on the various angles for lighting prove that the new design provides a more desirable distribution. As extruded shapes, the louvers are rigid and provide the same distribution over long periods of time.

50-lb. ingot



25-lb. ingot

10-lb. ingot

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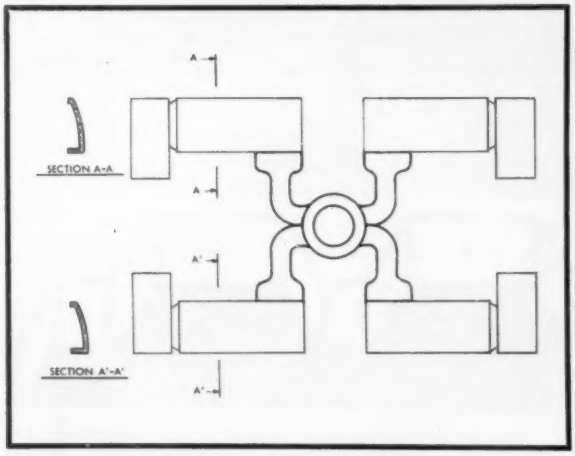
GATING ZINC DIE CASTINGS

By **RALPH WILCOX**, *Metallurgist, American Smelting and Refining Co.*

Parts I and II on current practices for gating zinc die castings appeared in May and June 1961. This article is part III and continues the discussion on circular or tubular castings.



13. FOUR CAVITY ARRANGEMENT of an automotive ash tray cover casting is illustrated. A-A shows the incorrect position of the casting for ease of gating, and the correct position is shown by A'-A'.

MULTIPLE CAVITY ARRANGEMENT

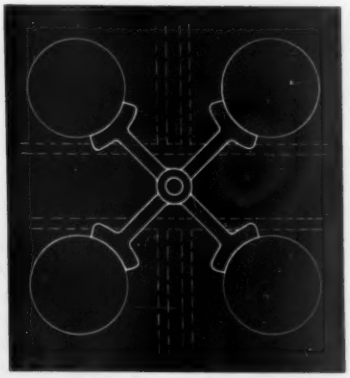
THE ABILITY TO SUCCESSFULLY GATE multiple cavity dies is dependent to a great extent on how the cavities are arranged in the die block. Therefore, it is essential to consider this aspect at the time the die is being designed.

For example, figure 13 shows an automobile ash-tray cover casting as produced in a four cavity die. The layout of the cavities in the die is satisfactory. But due to the nature of the cross section it will be more difficult to gate the casting to obtain good finish if the cavities are positioned as shown by cross section A-A rather than as in A'-A'. With the positioning shown in A-A the incoming metal from the gate will impinge directly against the core causing considerable turbulence and possible soldering near the gate. Positioning as shown in A'-A' avoids these hazards.

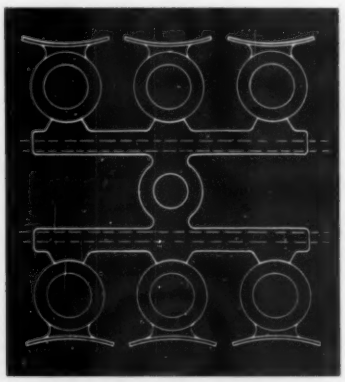
Figures 14 and 15 show two possible arrangements of a circular casting produced in a four cavity die. Both permit satisfactory gating, but with the gate and runner arrangement shown in figure 15 it is easier to provide adequate cooling of the gate and runner areas. As a result a four cavity die gated in this manner can be operated at a higher rate of production than one that does not permit adequate cooling.

Opposed to this, the gate and runner arrangement shown in figure 14 permits more direct metal flow

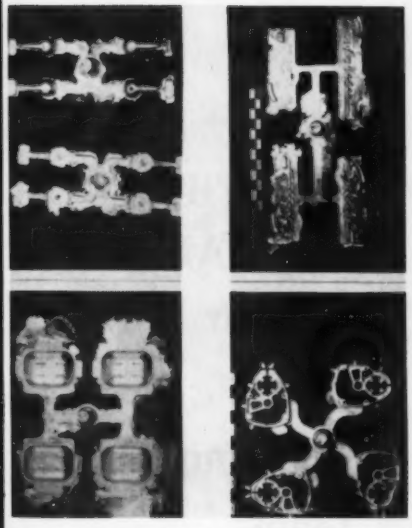
14. SATISFACTORY GATING of a circular casting in a four cavity die.



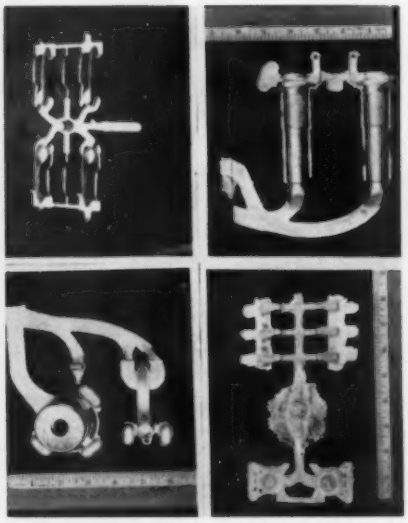
15. SATISFACTORY GATING gives adequate cooling gate and runner.



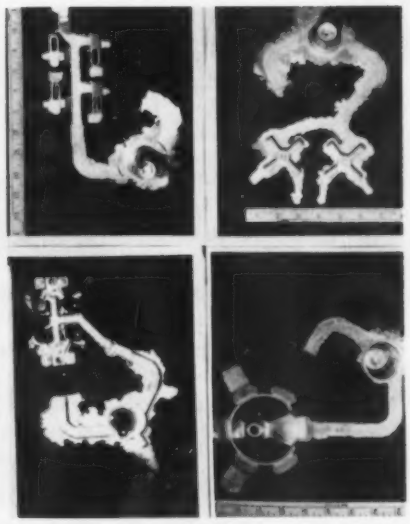
16. SIX CAVITY DIE is good for small castings made in quantities.



18. COMMERCIAL APPLICATIONS of multiple cavity arrangements.



19. COMMERCIAL APPLICATIONS of the unit die system. Die cost is minimized.



20. COMMERCIAL APPLICATIONS of the unit die system. Coring is restricted.

with somewhat less turbulence in the runner than obtained in figure 15. However, whether or not turbulence in the runner system has any significant adverse effect upon the surface finish of the casting is a moot question.

In the early days of die casting, gate runners were designed to avoid abrupt changes in the direction of the metal flow before its entry into the casting cavity. Experience over the years has shown that this is not so important as first thought. Many die casters have found that even a 90° change in the direction of the gate runner has little effect upon the surface finish of the casting. Furthermore, in certain die casting plants where high injection velocities are used, sharply curved runners have caused the die to erode or pit on the inside portion of the curve. The mechanism of die pitting is thought to be similar to that of cavitation taking place in propellers.

Three possible arrangements of a gear shift control, support bracket, casting for an automobile as produced in a six cavity die are shown in figures 16 and 17. Note that the production of this casting requires a core or slide pull 90 degrees to the direction of the die opening.

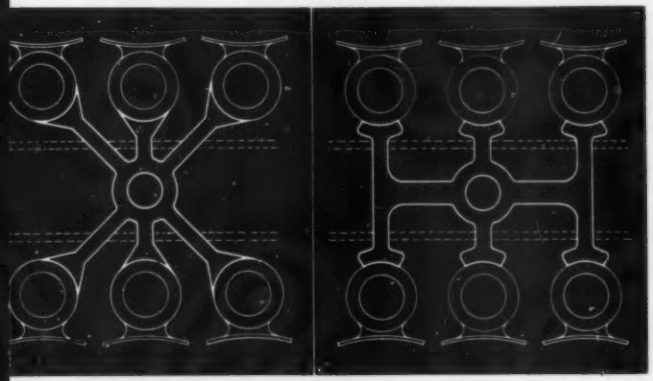
All three arrangements permit satisfactory gating and will produce good castings. However, the arrangements shown in figure 17 use unequal runner lengths and present a more difficult problem of cooling the gate and runner areas.

Multiple cavity arrangements are costly but ideal when the castings are relatively small and production schedules call for several thousand pieces per day. However, for large castings weighing one or two pounds or more and requiring a hardware finish, multiple cavity arrangements beyond two seldom produce satisfactory results. In these cases, it is usually better to make two single cavity dies and get the needed production by running these on smaller, faster machines.

A way to avoid the high cost of multiple cavity dies and still obtain their production economy is to use unit dies. This is an arrangement where a master die block serves as a holder for four rectangular or circular insert dies.

In the unit die system die cost is held to a minimum with the production economy of a 4-cavity die. However, the unit die system has several disadvantages in that: (a) production speed is controlled by the slowest running unit of any particular set of four units being produced, (b) coring possibilities are restricted, (c) water cooling is more difficult, and (d) gate placement is limited. As a result it is usually more difficult to obtain a hardware finish on castings produced in a unit die than in a conventional multiple cavity die.

Photographs of several commercial applications of multiple cavity arrangements are shown in figure 18. Photographs of unit die applications are shown in figures 19 and 20.



17. IN A SIX CAVITY DIE with unequal runner lengths, cooling of the gate and runner lengths is difficult.

Part IV of this article will appear next month.

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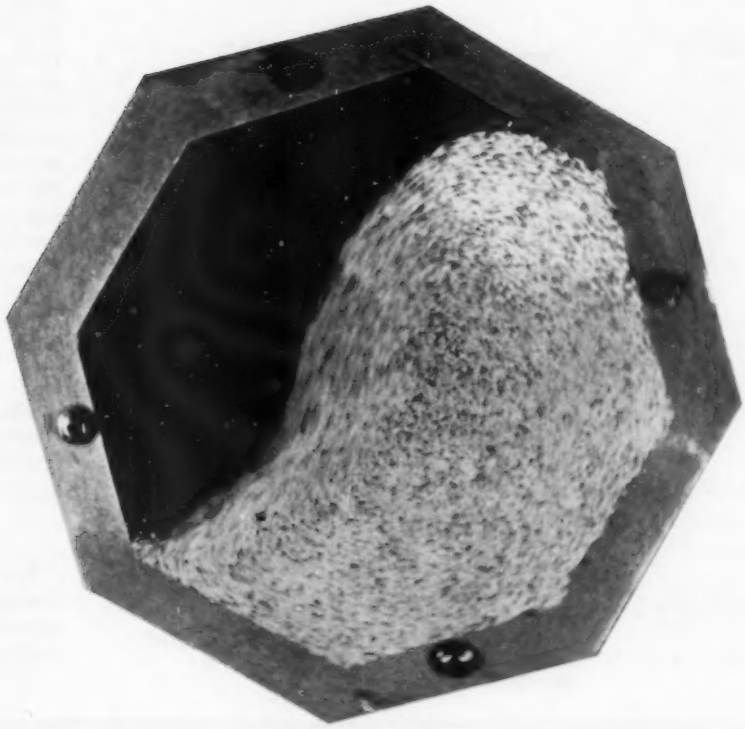


DESIGNING FOR BARREL AND VIBRATORY FINISHING

By **RONALD KHOL,** *Associate Editor*

"MOST PARTS ARE DESIGNED to be finished by hand," laments one barrel finisher. He's right. Finishing often is one of the biggest manufacturing costs. Yet many designers ignore it.

Barrel and vibratory finishing improves surface condition and appearance, and removes flash, burrs, and sharp edges. Your part probably needs at least one of these finishing treatments. How well the economical bulk methods can finish your part depends on its design.

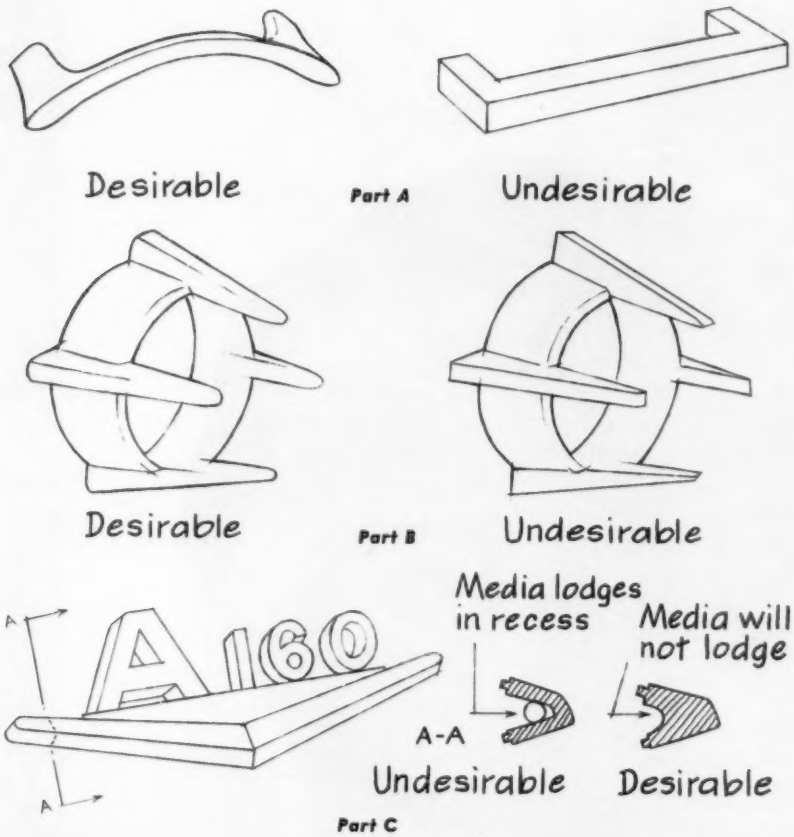
The results of barrel and vibratory finishing are similar. You use one or the other depending on circumstances. The merits of one versus the other is a hot topic which PMM will cover in coming issues. The thing to remember, however, is that essentially the same design considerations apply for both barrel and vibratory finishing.

Design considerations

Minor modifications to part shape can make finishing faster and less costly. Consider the points on the following pages if you are designing a part to be finished by bulk methods.

Part A

Avoid large flat surfaces. They are difficult to finish, especially if they occur with sharp



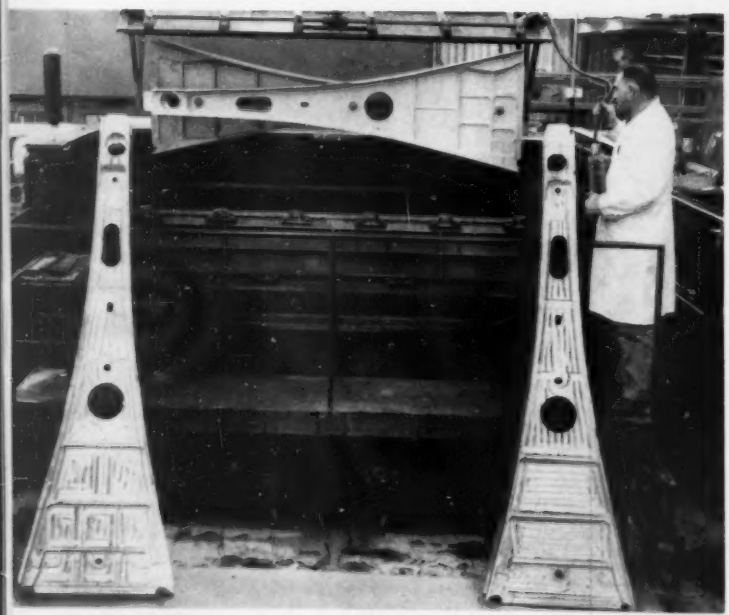
edges and corners. The drawer pull (left) is ideally shaped for bulk finishing. There are no hard-to-reach areas. The part has clean lines over which media flows evenly. There are no areas in which media can lodge. The pull on the right serves the same purpose, but is much more difficult to finish. Also, a die cast square design would probably require shallow draft angles on the trim die. This might score the surface, requiring longer finishing times to remove the scoring marks.

Part B

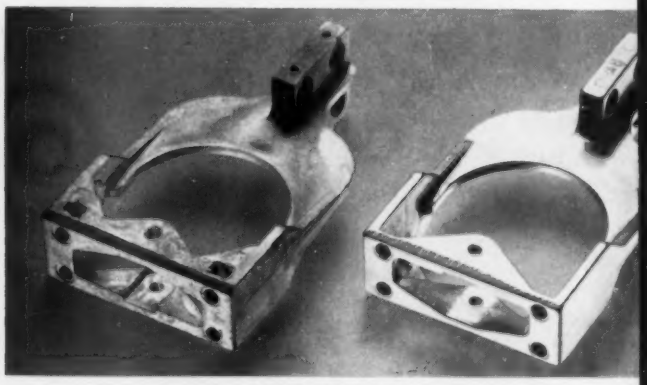
Avoid sharp projections. They nick, scratch, and hit each other unless you take special care. Rounded fins on this part permit finishing more parts at one time, lower piece costs.

Part C

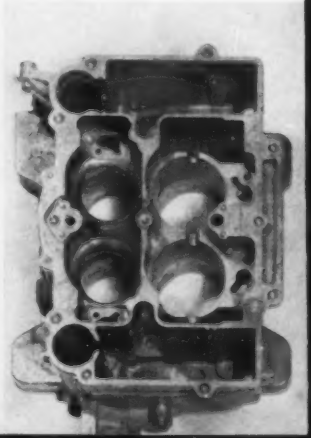
Try to avoid blind holes or slotted sections, even if they are not on a surface that needs good finishing. The important surface



THIS 93"-LONG AIRCRAFT WING SPAR shows that size need not stop you from using barrel finishing. Barrel finishing blended the radii, improved surface finish, took less time than hand methods, turned out more uniform results. Modifications to basic bulk finishing techniques make it possible to finish tremendously large parts.



THIS PART was barrel finished to remove flash and burr Finished part on the right shows general surface improvemen blended parting line, and removal of sharp edges.



TO REACH SHIELDED AREAS of this part called for vibratory finishing. Requirements: internal and external flash removal, blending trim and parting lines, breaking sharp edges. Vibratory finishing costs 87% less than hand finishing. Finished part is on the right.

on this part is well designed for finishing. The fine finish specified requires the use of small media. But the slot on the back of the part traps the media best suited to produce the specified finish.

Part D

Allow large radii where surfaces meet at right angles if you need a uniform finish. To be reached, fillets must have diameters larger than that of the media. This item is not so important if you use non-spherical media.

Part E

Avoid or reduce recessed areas, especially if a uniform finish is specified. But be careful! Adding material might make the part too heavy, or cause warpage or porosity if it's a casting.

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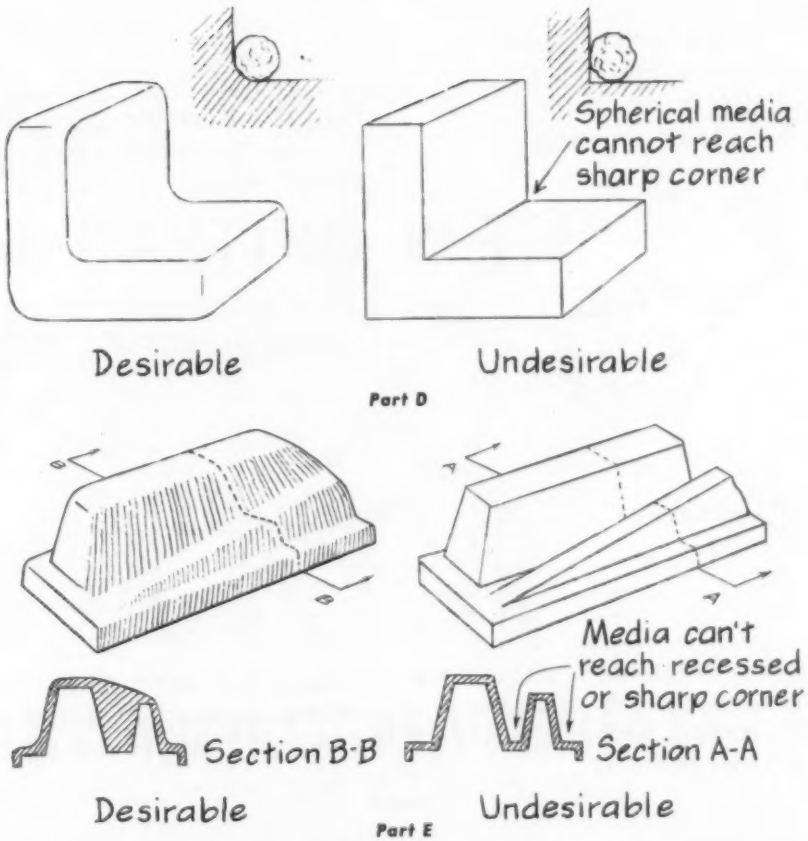
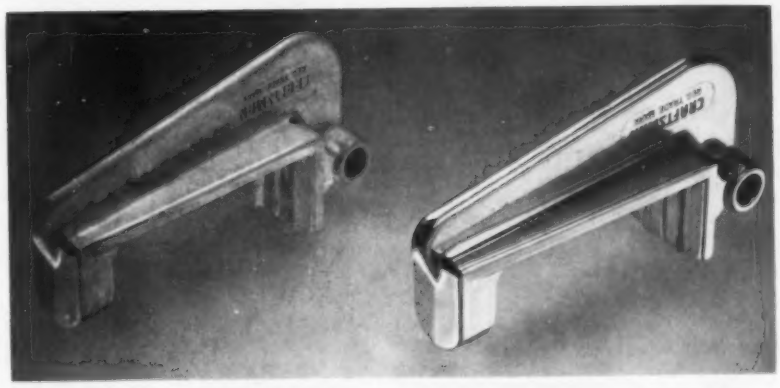
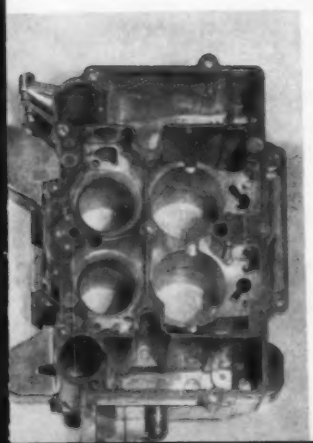
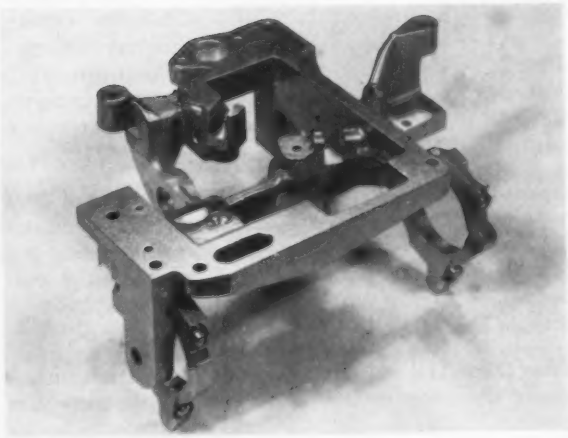


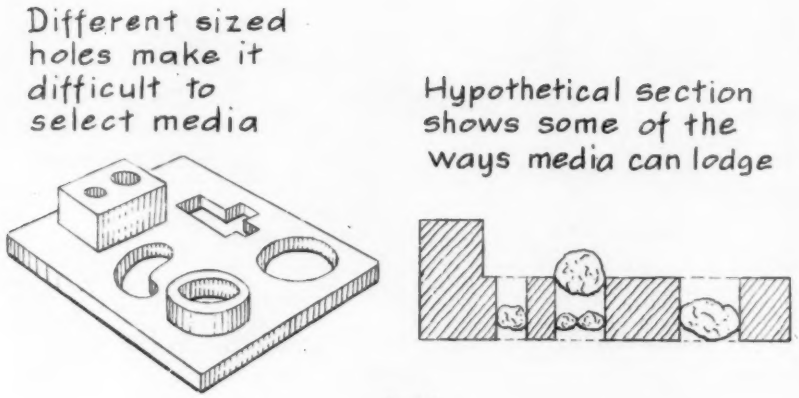


BEFORE (left) AND AFTER VIEWS of a barrel finished part for a small tool. Specifications called for a bright, lustrous finish and removal of all sharp edges and flash. Large radii made it easy to reach all areas, provide a uniform finish.



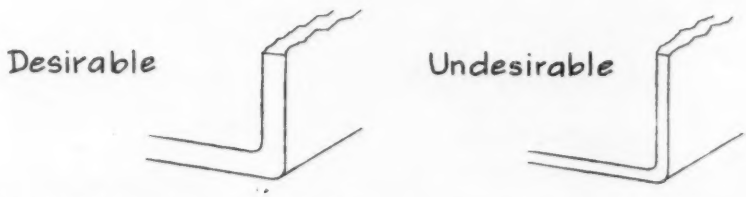
THIS PART IS VIBRATORY FINISHED because of shielded areas. Requirements: blend machining marks, surface improvement, break sharp edges, remove flash. Vibratory treatment cut finishing costs more than 90%.





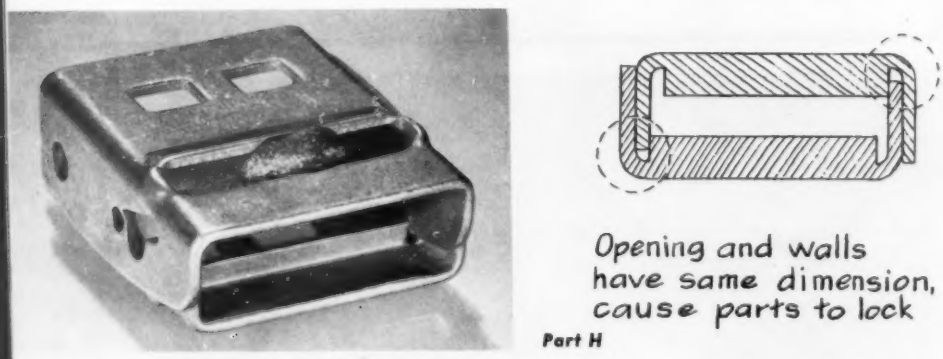
Part F

Standardize hole size if possible. This part has so many holes of different diameters that it is hard to find a media that won't lodge in at least one of them.


Desirable
Undesirable
Wall thickness should be adequate to resist damage from possible impingement
Large parts with thin walls may tend to bend or break if parts impinge

Part G

Watch excessively-thin wall sections. They may tend to bend or break unless special care is taken.



Part H

Watch out for possible locking or tangling in the barrel. The opening between the rib and wall in these parts is the same as the wall thickness. The wall wedges into the opening during vibratory finishing, locking the parts together firmly. Also note the chip wedged into the slot.

And that's not all

Alloy, manufacturing process, and secondary operations before bulk finishing also affect the results.

Alloy—Certain alloys, particularly aluminum, turn dark in the presence of alkalies or some abrasives. Keep this in mind when considering decorative finishes.

Powdered Metal Parts—Highly porous parts soak up too much solution, may retain a chemical residue after finishing. If you try to save money by specifying low density, the part may cost more in the end because you may not be able to get the economies of bulk finishing.

Trim Dies—Make sure that casting gates are trimmed closer than the tightest dimensional tolerance. Example: if you trim a gate to 0.003", you probably won't be able to hold a 0.002" tolerance in a finishing barrel.

Production Scheduling—Don't assume that you must do all bulk finishing at one point in the manufacturing cycle. Consider rough finishing and final finishing at different points during production. It may suit your needs better.

A final tip that won't cost you anything and may save you a lot. Call in a barrel finisher (or media supplier if you have your own machines) before you determine the final design. Let him give his views on how economically your design can be bulk finished. His recommendations may save you money.

Material for this article was contributed by the Roto-Finish Company, Micro Deburring Company, and the ALMCO Queen Products Division, King-Seeley Thermos Co.

BETTER
METAL CASTING WITH
HARBISON-WALKER
REFRACTORY MOLD MATERIALS

H-W Flintgrain for ceramic shell molds

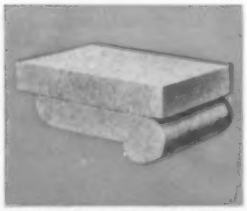
H-W FLINTGRAIN is an alumina-silica product of high refractoriness having very desirable low thermal expansion characteristics.

The angular grain shape and optimum size distribution make H-W FLINTGRAIN ideal for securing maximum compactness in the mold. It is used with special benefit for making ceramic shell molds and for similar applications in which dense, compact mold sections of greatest volume stability at all temperatures are of paramount importance.

Illustration of angulate shape of H-W Flintgrain enlarged x3

H-W Mullite Grains and Flours for precision molding of metals at extremely high temperatures

These H-W Mullite products by virtue of their high-alumina composition and low content of basic oxides are exceedingly refractory. The hard dense grains are strong and most resistant to fluxing. Excellent thermal stability accounts for their unusual constancy of volume up to their temperature limit. The maximum thermal expansion of these mullite products is approximately 0.6 per cent which is less than half that of silica sand. These are the properties which make them especially suitable for precision casting work at high temperatures with particular benefit for various non-ferrous and ferrous alloys.



Illustrated here is a typical two-part mold in H-W Mullite material made for the precision casting of a beryllium-copper alloy.

HARBISON-WALKER REFRACTORIES CO. and subsidiaries

World's Most Complete Refractories Service GENERAL OFFICES: PITTSBURGH 22, PENNA.

HW 60-28

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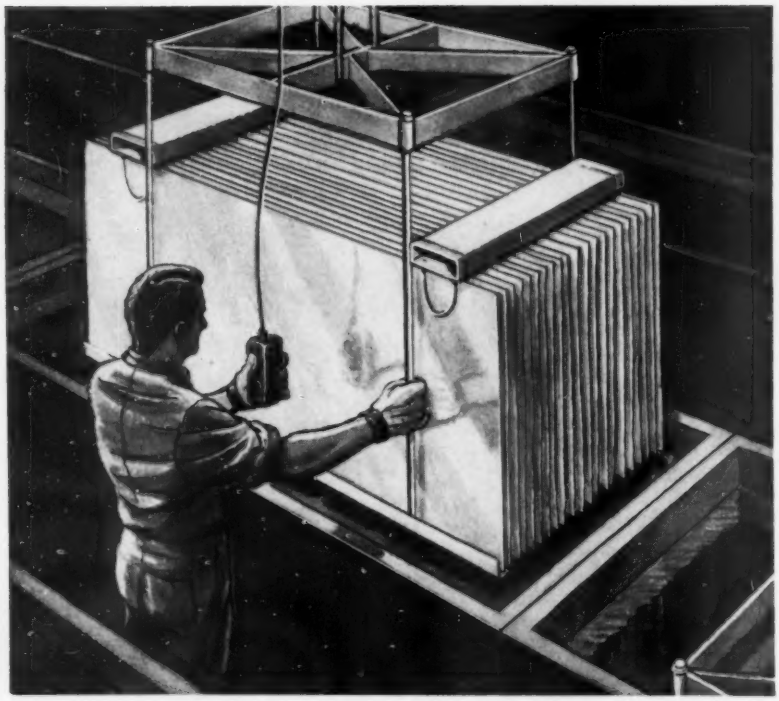

Stencil inks, shop soils disappear fast in Oakite Aluminum Cleaner 164

Here is a heavy duty yet perfectly safe alkaline cleaner for all aluminum alloys. Parts immersed in a tank of Oakite 164 emerge free of even the most tenacious identifying inks, greases and other shop soils. There's no etching at all.

Air agitation of this efficient, non-foaming solution speeds cleaning action, although Oakite 164 works efficiently even without this aid.

To meet *any* aluminum cleaning requirement—ask Oakite. There's a *whole line* available—solvent as well as alkaline. Whichever is recommended, you can be certain of service as well as safety. Send for Bulletin B-6395. Oakite Products, Inc., 45B Rector Street, New York 6, N. Y.

it PAYS to ask Oakite

OAKITE

over 50 Est. 1909 SCIENCE

years' leadership in industrial cleaning

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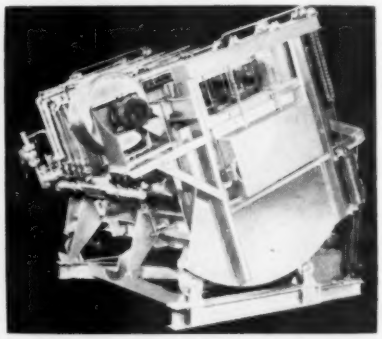
new products & developments

Continued from page 13

Tilt-type melting furnace

J. A. KOZMA CO.—The RTPW radiant melting furnace delivers



metals with high purity, low porosity and less than 1% metal loss. Fast, uniform heat is applied to aluminum or magnesium.

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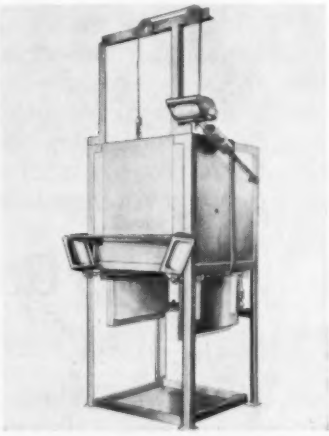
Shell mold furnace

ALEXANDER SAUNDERS & CO., INC.—Industrial shell investment mold furnace is easily installed in small working areas for maximum opera-



tor convenience. Gas-fired with heating temperatures to 1800°F., it is used for firing all shell investment casting molds.

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Uniform micropowders

LINDE COMPANY—Uniform micropowders of refractory compounds are solid, uniform in particle size and composition, and do not ag-

glomerate. For refractories, columbium carbide and titanium carbide powders less than 44 microns in size and of homogeneous composition have been made.

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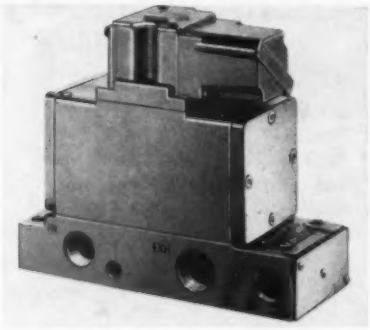
Air control valves

HANNIFIN COMPANY—Four-way, pilot operated air control valves have both momentary and maintained contact electrical actuation.



Maximum time required for chamber fill and exhaust is fast because of the valve's exceptionally fast shift and large flow capacity. The valve can be mounted in any position.

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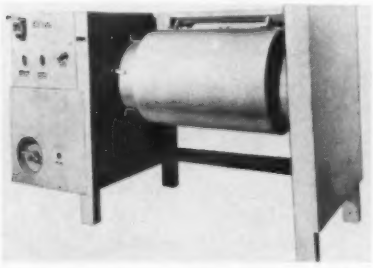
Barrel finishing

MINNESOTA MINING & MANUFACTURING CO.—Vibrotohone vibrating-rotating tumbling barrel allows handling many finishing jobs in



sequence without reloading the barrel. A variable speed drive and motor allows the operator simultaneous control of frequency and degree of vibration.

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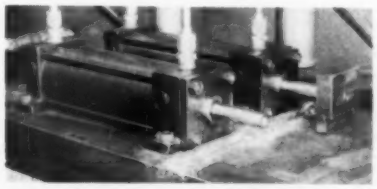
Piston rods

HYDRO-LINE MFG. CO.—Piston rods with stud ends are forty times more resistant to fatigue failure over conventional ⅝"-diameter cylinder rods. The resistance cuts machine downtime from cylinder failure.



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Pre-paint treatment

TURCO PRODUCTS, INC.—Turco W. O. #1, cleans, passivates and removes corrosion from metal surfaces in preparation for pre-paint treatment. As a cleaner it makes a slightly porous surface which absorbs primer. Brush, spray or swab it on.

Circle No. **244** on Reader Service Card

more New Products on next page

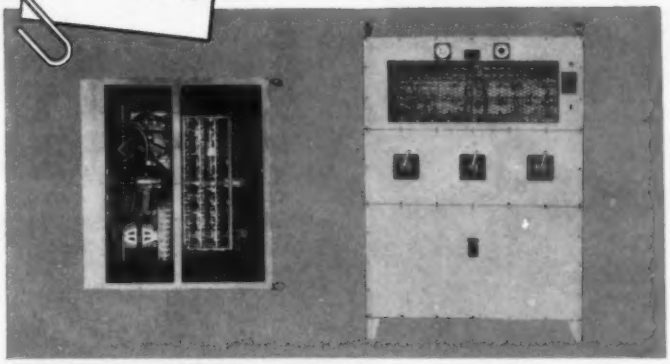
SYNTRON

CASE HISTORY

another successful application in the

No. 3471

ELECTROPLATING INDUSTRY



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by installing a

SYNTRON RECTIFIER POWER UNIT

Slightly less than a year ago, Industrial Plating Company of Cleveland, Ohio replaced a motor generator and selenium rectifier power unit with a Syntron 6000 amp, 5-15 volt Silicon Rectifier Power Unit. A spokesman for the Company declares that since this unit was installed, power bills have not exceeded $700.00 a month against an average of $1100.00 per month with the old units. This is a 36% reduction in power cost.

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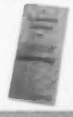
Syntron Rectifier Power Units are designed for industrial applications. Each according to Specific power needs. This savings in power costs realized by Industrial Plating Company can apply to your operation.



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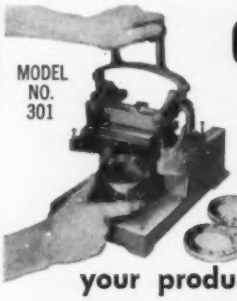

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new products & developments

Continued

Cleaning compound

GRAV-I-FLO CORP.—Belt-Life cleans abrasive polishing belts and wheels. The compound extends belt or wheel life, and prevents them from getting loaded with metal thereby maintaining a high cutting speed.

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Zinc etch

MARTIN-SENOUR CO.—Galva Etch cleans and etches zinc surfaces preparatory to painting. Simply wipe or brush it on, allow it to work, rinse, and wipe dry.

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Anti-tarnish mixture

LEA-RONAL INC.—No-Tarn "EC" mixture gives high tarnish resistance on non-ferrous metals, such as electroplated brass, copper, as well as solid brass, and other copper-base alloys.

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more New Products on Page 54

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each PMM page is a handy reference sheet thanks to its costly new perforated binding

TEAR SHEETS are easy to pull. This is one more way we are making PRECISION METAL MOLDING a more useful and readable magazine. We've changed the binding, and the page size.

BINDING—When you open the book, notice how flat the pages lie. The reason is the perforated binding which also makes it easy to pull tear sheets. All editorial and advertisements become handy reference materials.

Look closely at the binding. You'll notice that each page is perforated. When you want a tear sheet, open to that page and press the book open lightly. Then just tear out the page.

With perforated binding, all editorial and photographs are visible right into the binding. Because the pages lie flat as opened, pages don't flip unexpectedly.

LARGER PAGES—Starting with the June issue, the magazine page size was increased to 8½-inches by 11½-inches. Readability is improved and the wider margin means more and better display space.

PMM Precision Metal Molding

a publication of
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Low-cost answer to hydraulic fluid safety... UCON Fire-Resistant Hydrolubes

ARE you running the risk of being burned out of business by a sudden hydraulic line break that sprays flammable fluid into a hot and hazardous area?

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UCON hydrolubes are balanced formulations of a water-soluble polyglycol thickener in an ethylene glycol-water base. Selected additives keep pump replacement costs low and provide maximum liquid and vapor-phase corrosion resistance. As long as water content is adequately maintained, UCON hydrolubes give complete protection from flash fires; they also have successfully passed 100 per cent oxygen atmosphere spray flammability tests.

UCON hydrolubes come in viscosity grades to meet all system needs and operating conditions. Their viscosity-temperature properties are better than those of other types of fire-resistant fluids and petroleum oils.

Conversion from flammable petroleum oils or non-aqueous fire-resistant fluids to fire-resistant UCON hydrolubes is quick and easy. No special packings and seals are required. In many instances, leakage loss is reduced.

For complete information on the economy and efficiency of UCON safety hydraulic fluids, and the simple conversion steps for your systems, call your CARBIDE Technical Representative, or write: Union Carbide Chemicals Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, New York.

UNION CARBIDE CHEMICALS COMPANY

UNION CARBIDE

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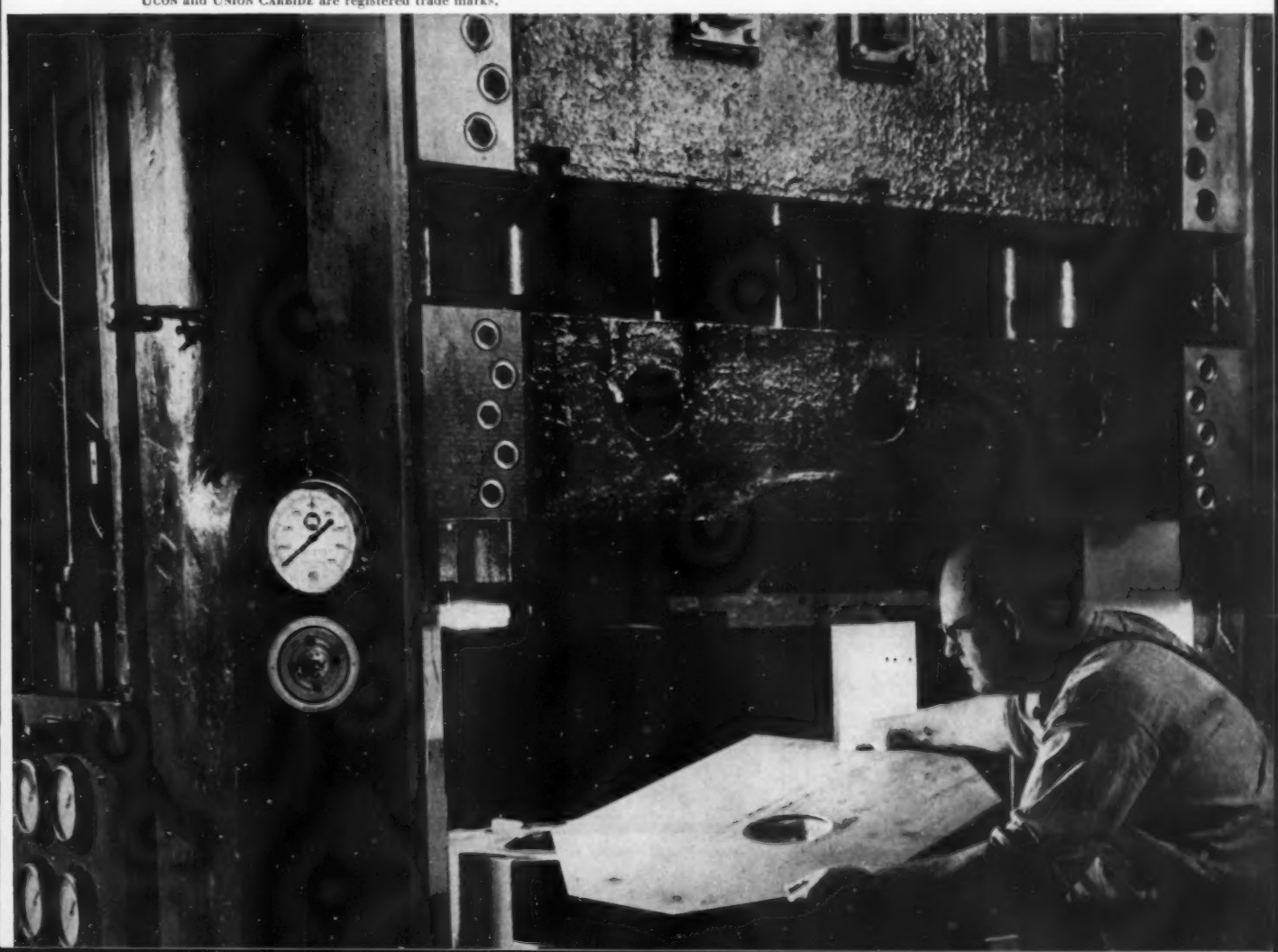

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THIS TRIGGER is your control over mold cavity surfaces - cleans, cools, lubricates in ONE OPERATION

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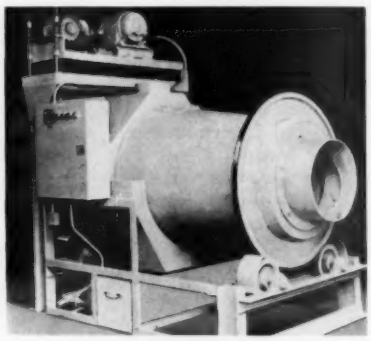
new products & developments

Continued

Tumble finishing

MINNESOTA MINING & MANUFACTURING CO.—Barrel finishing equipment minimizes hand labor in batch drying and polishing of metal parts. Other features of the 36" sawdust barrel include automatic control of tumbling cycles, automatic separation and media retention, and automatic discharge of finished parts.



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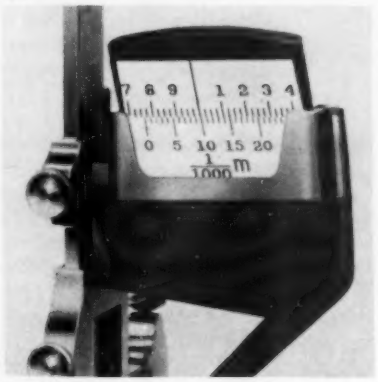
Magnifier

PAN TECHNICS, INC.—The Mark V magnifier simplifies gauge readings.



Magnification is 2.5 times. When used on gauges and scales on milling machines, jig borers, radial drills and other equipment, it saves the operator reading time.

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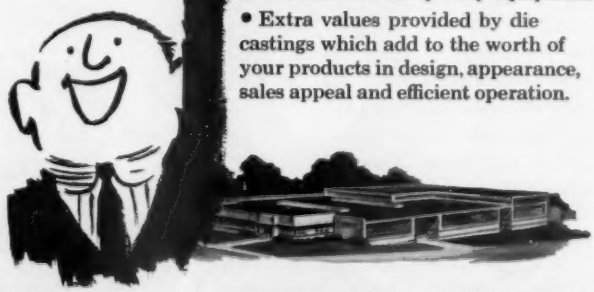

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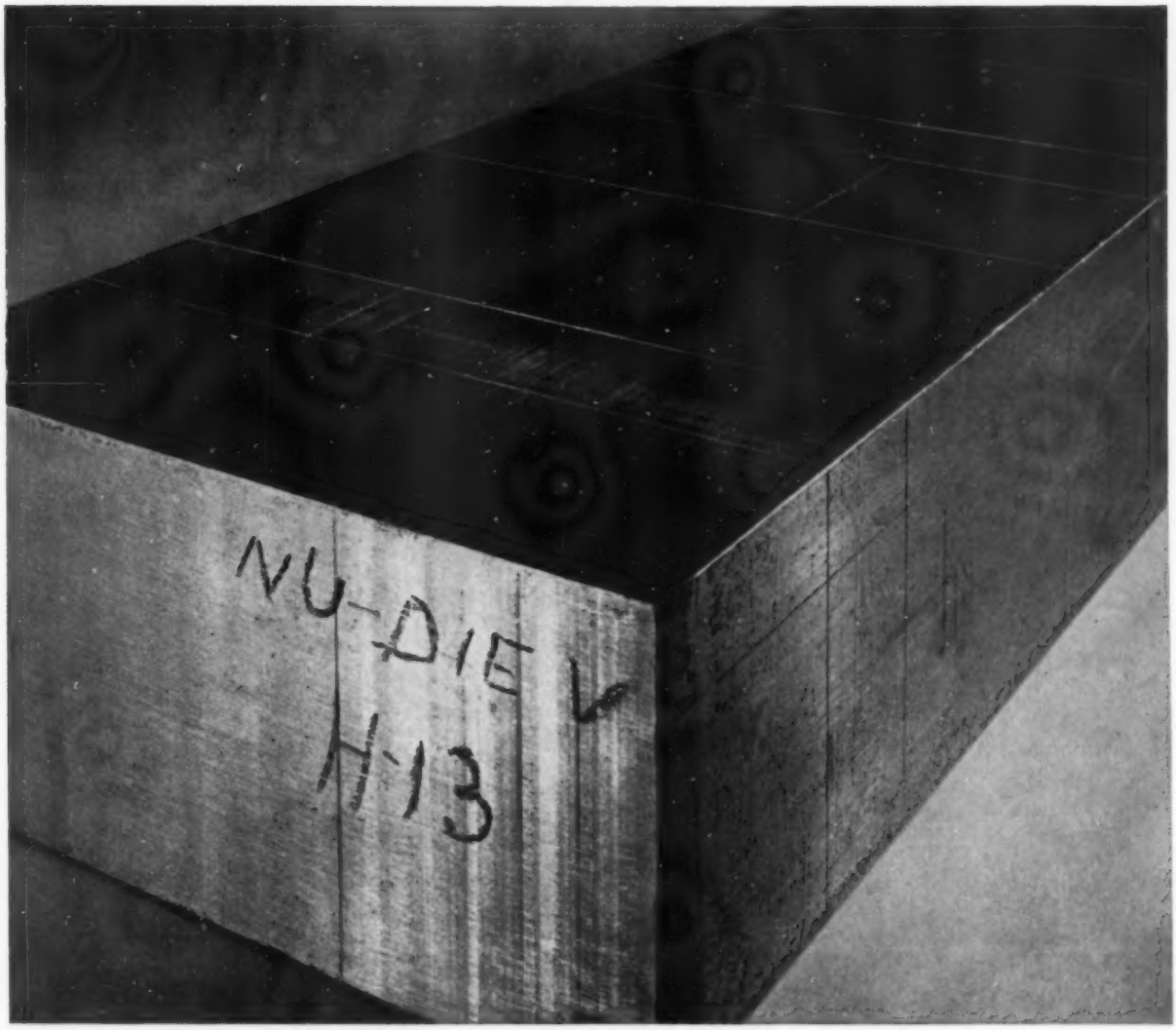

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The DENSIFYING process, developed by Crucible, involves more than the normal consideration of steel analyses and amount of reduction. It includes careful appraisals of ingot size and shape, processing temperature control, and special methods of reduction. Only Crucible successfully combines all these techniques to produce this more uniformly *dense* Type H13 steel.

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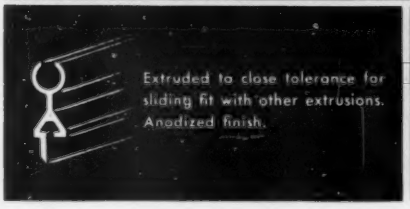
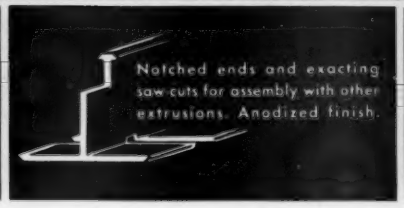
when you design





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Every piece of Superior aluminum extrusion fits perfectly into a J. A. Wilson Lumatrax suspended light diffusing unit, pictured in the above ceiling. Every extrusion has been factory checked for "customer-specified" tolerances. This is most important with Lumatrax since units must be fitted together in the field. The consistent uniformity of Superior extrusions meets the exacting demands of modern production lines and the high quality requirements of today's products.

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PMM

useful literature, catalogs, manuals *qualified readers may obtain any of these technical publications by circling the numbers on the reader service cards.*

PROCESSES

150 *Powder Metallurgy*—ASCO SINTERING CORP.—Brochure describes how to save 40% or more on machine parts, through powder metallurgy.

151 *Centrifugal Casting*—THE CENTRIFUGAL CASTING CO.—8-page Brochure gives technical and design data on the centrifugal casting process.

152 *Casting Defects*—FOSECO, INC.—8-page Magazine discusses common casting defects and practical solutions.

153 *Shell Mold Casting*—LEBANON STEEL FOUNDRY—6-page Brochure describes and illustrates the shell molding process, the Ceramicast process and the combined ceramic mold and lost wax techniques.

154 *Investment Casting*—MIDWEST PRECISION CASTINGS CO.—Booklet gives process information, case histories, design principles and a materials chart for investment casting. The benefits and limitations of the lost-wax process are discussed.

155 *Die Casting*—NEWTON-NEW HAVEN CO.—6-page Brochure describes how to use Prototype Die Casting Service to best advantage.

156 *Powder Metallurgy*—RUSSELL, BURDSALL & WARD BOLT AND NUT CO.—Brochure gives technical data on designing for powder metallurgy with sintered parts made from brass, bronze, copper, monel, nickel silver, and ferrous powders.

MATERIALS & EQUIPMENT

160 *Atmosphere Equipment*—LINDBERG ENGINEERING CO.—Technical bulletin describes an inert atmosphere generator.

161 *Refractories*—HARBISON-WALKER REFRACTORIES CO.—8-page Reprint discusses research methods in the development of refractories for aluminum melting furnaces.

162 *Zinc Flux*—THE HAVILAND PRODUCTS CO.—Technical bulletin describes flux treatment of zinc melt dross.

163 *Furnace Controls*—MINNEAPOLIS-HONEYWELL REGULATOR CO.—Catalog gives technical data on a complete line of furnace and oven control equipment.

164 *Tool Steel*—THE CARPENTER STEEL CO.—Technical data sheets describe a new tool steel that can be heat treated to tensile strengths over 350,000 psi.

165 *Mesh Belt Furnace*—GENERAL ELECTRIC CO.—4-page Bulletin gives technical data on a mesh belt furnace for continuous bright brazing, heat treating or sintering.

166 *Protective Atmosphere Equipment*—LINDBERG ENGINEERING CO.—Technical bulletin gives data on an endothermic generator for producing protective atmospheres.

167 *Vacuum Equipment*—CONSOLIDATED VACUUM CORP.—28-page Bulletin gives technical data on a complete line of high vacuum valves, baffles, and traps.

168 *Mesh Belt Furnaces*—HARPER ELECTRIC FURNACE CORP.—Bulletin gives technical data on a line of straight through mesh belt furnaces for brazing, annealing and sintering.

169 *Bronze for Extruding*—AMERICAN SMELTING AND REFINING CO.—Technical brochure describes several bronze alloys for continuous casting.

170 *Carbide Parts*—VASCOLOY-RAMET CORP.—Price List No. 5 gives price reductions for items in Catalog VR-58. Parts include carbide blanks and tools, carbide and ceramic inserts, tantung cast-alloy tools, toolholders and face mill cutters.

171 *Powdered Titanium*—CLEVITE CORP.—Technical bulletin outlines potential of using sintered parts made from powdered titanium.

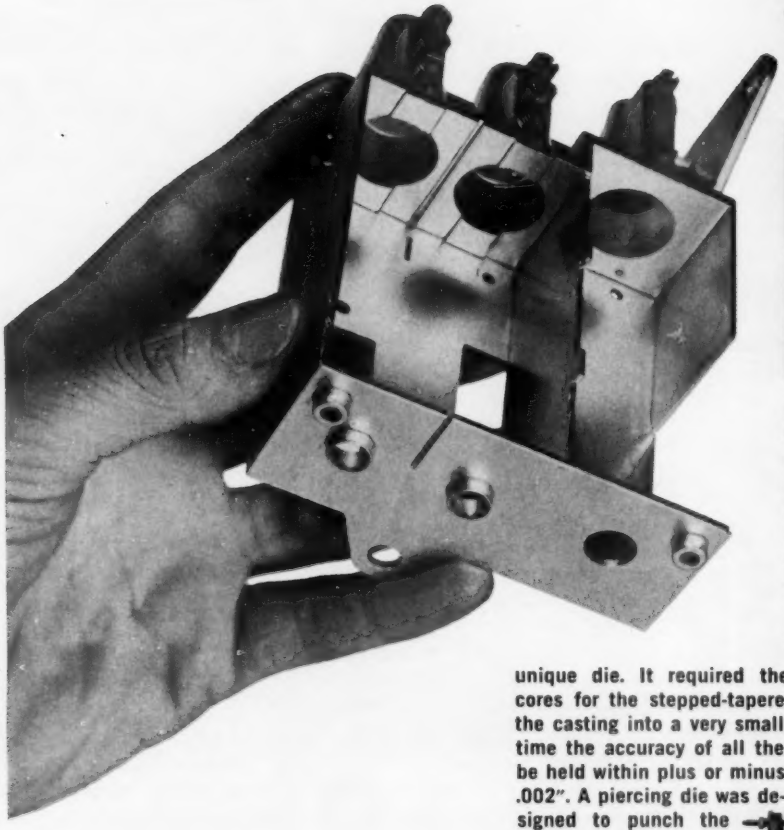
172 *Insulated Thermocouple Materials*—TEMPTRON, INC.—Brochure gives technical data on metallic sheathed ceramic insulated wire and thermocouple material.

173 *Standard Molds*—DETROIT MOLD ENGINEERING CO.—6-page Brochure describes savings possible through use of standard molds and accessory equipment.

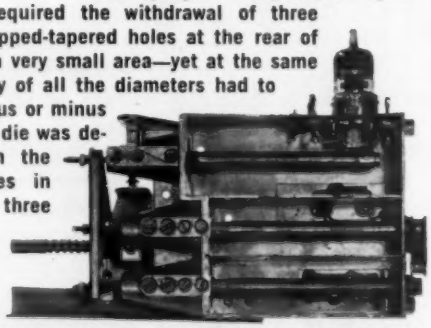
174 *Diffusion Furnaces*—LINDBERG ENGINEERING CO.—4-page Bulletin gives technical data on gaseous and solid diffusion furnaces.

more Useful Literature on page 59

HOW eLSe WOULD YOU MAKE IT?



■ Supplying this Motorola television tuner housing on a volume basis could have been a real production headache—were it not for the crackerjack combination of a die caster's skill and Zamak. With the performance virtues of these remarkable zinc die casting alloys in mind, Serv-All Tool and Die Company carefully worked up a unique die. It required the withdrawal of three cores for the stepped-tapered holes at the rear of the casting into a very small area—yet at the same time the accuracy of all the diameters had to be held within plus or minus .002". A piercing die was designed to punch the quarter-inch holes in the housing's three "ears" as well as several undercuts impossible to cast. These holes were also held to plus or minus .002". ■ Serv-All knew Zamak could give them the castability they needed, could meet the demanding tolerances, could provide the high-strength, thin-wall sections required, and had the ductility for an accurate, easy piercing operation after casting. They also knew of the overall production economies inherent to Zamak—low die cost, long die life and high production speeds. One other characteristic of Zamak sealed the choice—the wide variety of finishing procedures which can be used. In this case the housing is copper-plated to facilitate soldering.



MOTOROLA TELEVISION TUNER HOUSING

AWARD OF MERIT

The New Jersey Zinc Company's "Zinc Die Casting of The Year" Competition

■ Zamak gives you more for less. How else would you make it?

HORSE HEAD® SPECIAL ZINC AND HORSE HEAD ZAMAK ARE PRODUCED BY

THE NEW JERSEY ZINC COMPANY

160 FRONT STREET • NEW YORK 38, N. Y.

DEVELOPERS OF THE ONLY STANDARD ZINC DIE CASTING ALLOYS IN USE TODAY

HORSE HEAD PRODUCTS

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useful literature, catalogs, manuals

175 ***Vacuum Degassed Steel***—A. FINKL & SONS CO.—Bulletin describes process for vacuum degassing steels to be used as die blocks or as hot work tool steels.

FINISHING

180 ***Vibratory Finishing Machine***—COLOR-MATIC SALES & SERVICE CO.—Brochure gives technical data on an open tub vibratory finishing machine that reduces time cycles and increases daily production over most other barrel finishing methods with more efficient control of quality.

181 ***Polishing Equipment***—CONFORMING MATRIX CORP.—Brochure describes a fill-wipe-polish machine for finishing dials, knobs and nameplates.

182 ***Letter Stamps***—THE ACROMARK CO.—4-page Brochure describes a line of steel stamps used to mark letters or figures in castings.

183 ***Metal Coatings***—S. C. JOHNSON & SON, INC.—Bulletin describes a complete line of special coatings for improving appearance of castings; also information on die releases and lubricants.

184 ***Finishing Machine***—HYPREZ DIV., ENGIS EQUIPMENT CO.—8-page Book describes techniques and accessories for the Di-Profiler reciprocating hand machine for finishing metal parts.

185 ***Abrasive Cloth Wheel***—MERIT PRODUCTS, INC.—Technical data sheet tells what abrasive cloth wheels to use to simplify sanding and polishing of complex parts.

186 ***Coated Abrasives***—ARMOUR ALLIANCE INDUSTRIES—4-page Brochure describes zinc stearate paper-backed abrasives and other products.

187 ***Metal Cleaner***—E. F. HOUGHTON & CO.—Data sheet describes a metal cleaner that leaves a rust protection coating.

188 ***Printing Machines***—THE ACROMARK CO.—4-page Brochure describes printing and marking machines for identifying or decorating castings.

189 ***Aluminum Cleaner***—ENTHONE, INC.—Data sheets describe an alkaline soak cleaner that does not contain silicates, but yet does not appreciably etch aluminum. The cleaner is used as a soak for zinc die castings.

190 ***Abrasive Compound***—WHEEL TRUEING TOOL CO.—Technical catalog describes diamond abrasive compounds and diamond powder for use in rough lapping castings to mirror finishes.

geared for success

Designing is a frustrating job. You carefully draw up a blue-ribbon assembly that is a model of efficiency, only to have Manufacturing say it will cost too much. These prize-winning gears could have met that same fate, but they were designed for powder metallurgy.

Compacted from brass powder, they combine the functions of gears and cams in precise contours economically impractical by traditional means of gear cutting. They contribute to **reduced** overall production costs while providing the strength, corrosion resistance, exact part to part duplication and absolute reliability necessary as the working mechanism of the S. H. Couch Co. fire alarm pull box.

Fabricated by American Sinterings Division of Engineered Plastics, Inc., they are the Grand Prize winners in the "Nonferrous Metal Powder Part of The Year" competition sponsored by New Jersey Zinc.

Avoid going back to the drawing board—design for nonferrous powder metallurgy. Write for your copy of "Designing For Pressed Brass and Nickel Silver Parts."

HORSE HEAD® ATOMIZED NONFERROUS METAL POWDERS ARE PRODUCED BY

THE NEW JERSEY ZINC COMPANY

160 FRONT STREET • NEW YORK 38, N. Y.

DEVELOPERS OF BRASS & NICKEL SILVER POWDERS SETTING TODAY'S STANDARDS

HORSE HEAD PRODUCTS

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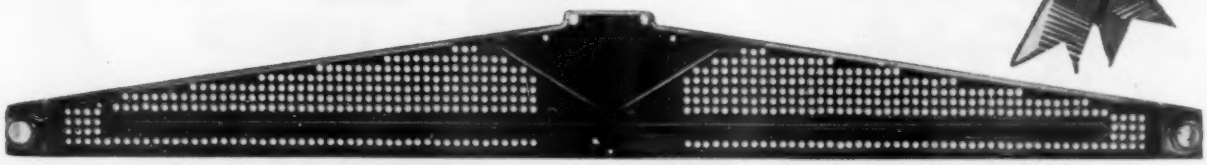
KUX MACHINE CO.

SALUTES

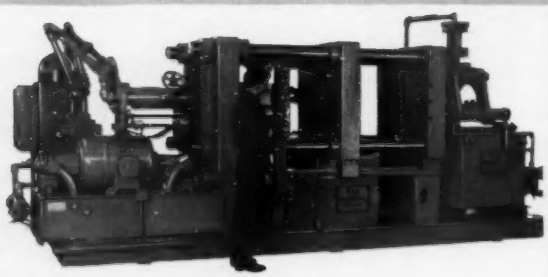
A&A die casting company

. . . top winner of the New Jersey Zinc Co.

"Zinc Die Casting of the Year" Award



A & A's $1,000-AWARD CASTING—THIS 6-LB. 32-INCH VACUUM CHAMBER FOR AMPEX DIGITAL TAPE HANDLER. CAST AT A SAVING OF 95% OVER PREVIOUS PRODUCTION METHOD.



Hydraulically operated plunger gooseneck model BH-600, with strain gage proven die locking pressure of 600 tons, produced the grand prize winner for A & A.

CONGRATULATIONS TO A & A on their achievement of manufacturing this exceptional wave guide die casting. The casting, having an unprecedented 515 cored holes, was made to the most exacting requirements and tolerances. Two slots running almost the entire 32 inches of casting length are only .007 inches wide, and a flatness within .002 inches end to end is achieved as specified. A perfect cast finish is also a must, as the part is hard chrome plated for wear resistance.

KUX IS PROUD, TOO—TO HAVE HELPED! To solve this and other difficult problems in precision die-casting, Victor Anderson and John Allen, founders of A & A Die Casting Company make almost exclusive use of many different models and sizes of Kux machines with their built-in engineering superiorities.

Write for full details of the 28 all-new KUX models illustrated in the latest KUX Die Casting Machine Catalog.

KUX MACHINE CO. • 6725 NORTH RIDGE • CHICAGO 26, ILLINOIS

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2	20	38	56	74	92	110	128	146	164	182	200	218	236	254	272	290	308	326	344	362	380	398
3	21	39	57	75	93	111	129	147	165	183	201	219	237	255	273	291	309	327	345	363	381	399
4	22	40	58	76	94	112	130	148	166	184	202	220	238	256	274	292	310	328	346	364	382	400
5	23	41	59	77	95	113	131	149	167	185	203	221	239	257	275	293	311	329	347	365	383	401
6	24	42	60	78	96	114	132	150	168	186	204	222	240	258	276	294	312	330	348	366	384	402
7	25	43	61	79	97	115	133	151	169	187	205	223	241	259	277	295	313	331	349	367	385	403
8	26	44	62	80	98	116	134	152	170	188	206	224	242	260	278	296	314	332	350	368	386	404
9	27	45	63	81	99	117	135	153	171	189	207	225	243	261	279	297	315	333	351	369	387	405
10	28	46	64	82	100	118	136	154	172	190	208	226	244	262	280	298	316	334	352	370	388	406
11	29	47	65	83	101	119	137	155	173	191	209	227	245	263	281	299	317	335	353	371	389	407
12	30	48	66	84	102	120	138	156	174	192	210	228	246	264	282	300	318	336	354	372	390	408
13	31	49	67	85	103	121	139	157	175	193	211	229	247	265	283	301	319	337	355	373	391	409
14	32	50	68	86	104	122	140	158	176	194	212	230	248	266	284	302	320	338	356	374	392	410
15	33	51	69	87	105	123	141	159	177	195	213	231	249	267	285	303	321	339	357	375	393	411
16	34	52	70	88	106	124	142	160	178	196	214	232	250	268	286	304	322	340	358	376	394	412
17	35	53	71	89	107	125	143	161	179	197	215	233	251	269	287	305	323	341	359	377	395	413
18	36	54	72	90	108	126	144	162	180	198	216	234	252	270	288	306	324	342	360	378	396	414

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5	23	41	59	77	95	113	131	149	167	185	203	221	239	257	275	293	311	329	347	365	383	401
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12	30	48	66	84	102	120	138	156	174	192	210	228	246	264	282	300	318	336	354	372	390	408
13	31	49	67	85	103	121	139	157	175	193	211	229	247	265	283	301	319	337	355	373	391	409
14	32	50	68	86	104	122	140	158	176	194	212	230	248	266	284	302	320	338	356	374	392	410
15	33	51	69	87	105	123	141	159	177	195	213	231	249	267	285	303	321	339	357	375	393	411
16	34	52	70	88	106	124	142	160	178	196	214	232	250	268	286	304	322	340	358	376	394	412
17	35	53	71	89	107	125	143	161	179	197	215	233	251	269	287	305	323	341	359	377	395	413
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- ☐ Investment Castings
- ☐ Powder Metal Parts
- ☐ Permanent Mold Castings
- ☐ Plaster Mold Castings
- ☐ Shell Mold Castings
- ☐ None of these

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data offered in this month's ads *qualified readers may obtain any of these free reference materials by circling the numbers on the reader service cards*

1. **Iron Powders**—Alan Wood Steel Co.—Literature on custom blended iron powders.

8. **Die Casting Machines**—B&T Machinery Co.—Information on a motorized die height adjustment on die casting machines.

11. **Trim Presses**—B.I.P. Engineering Ltd.—Bulletin describes a 50-ton semi-automatic or manual trim press.

14. **Fire-resistant Hydraulic Fluids**—Celanese Chemical Co.—Data available on safe hydraulic fluids available in six viscosity ranges.

17. **Tool Steels**—Crucible Steel Co. of America—Information on high-hardness CSM-2 and NU-DIE mold and die steels.

18. **Standard Unit Dies**—Detroit Mold Engineering Co.—Technical brochure describes how to get lower costs through standardization.

21. **Metal Powders**—The Glidden Co.—Technical bulletins on metal powders, listed in advertisement on page 5.

22. **Tiny Zinc Die Castings**—Gries Reproducer Corp.—Booklets include designer's check list for small zinc die castings.

23. **Die Casting**—Hampden Brass & Aluminum Co.—Brochure describes Behind The Scenes services and facilities for die casting.

25. **Investment Casting**—Hitchiner Mfg. Co.—Technical information on the ceramic shell method of investment casting.

26. **Stainless Steel Powders**—Hoeganaes Sponge Iron Corp.—Bulletin gives data on corrosion and wear resistant stainless steel powders.

OFFERED FOR THE FIRST TIME . . .

The services and reference materials listed here are being offered for the first time in this issue by new PMM advertisers.

63. **Powder Metallurgy**—Mueller Brass Co.—Offer services for designing and producing powdered metal, sintered parts including finishing and sub-assembly work.

69. **Pots**—Pottstown Machine Co.—Brochure describes a line of melting kettles for lead, zinc and aluminum industries. Many sizes of pots from stock, others on request.

30. **Die Casting Machines**—Kux Machine Co.—Catalog describes a complete line of die casting machines.

32. **Die Casting Machines**—Lester-Phoenix, Inc.—Specifications give complete data on die casting equipment that produces dense, flash-free parts.

33. **Die Casting**—Madison-Kipp Corp.—24-page Book shows some solutions to specific die casting problems.

36. **Fire-resistant Hydraulic Fluids**—Monsanto Chemical Co.—Bulletins describe how to prevent fire in die casting machines by using the correct hydraulic fluids.

39. **Non-ferrous Powdered Metals**—The New Jersey Zinc Co.—Brochure describes designing for pressed brass and nickel silver parts.

40. **Die Casting**—Newton-New Haven Co.—Brochure gives data to designers on the PDCS process of die casting.

41. **Aluminum Cleaner**—Oakite Products, Inc.—Bulletin describes a whole line of aluminum cleaners for all requirements.

45. **Lubricating Equipment**—Pierce-Waller, Inc.—Information on a system for lubricating, cleaning and cooling molds.

48. **Powder Metallurgy**—Reese Metal Products Corp.—Booklet tells how to cut costs by the Remet process.

52. **Power Units**—Syntron Co.—Brochure gives data on a complete line of rectifier power units.

53. **Pots**—The Tiffin Foundry, Inc.—Brochure lists a complete line of stock pots and die casting machine accessories.

55. **Tool Steels**—Uddeholm Co. of America—Technical information on tool steels for die casting and extrusion.

56. **Fire-resistant Hydraulic Fluids**—Union Carbide Chemicals Co.—Information on Ucon safety hydraulic fluids.

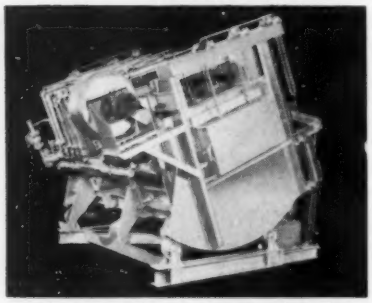
61. **Furnaces**—J. A. Kozma Co.—Information on a tilt-type melting furnace, also the model RH holding furnace for die casting and permanent mold.

KOZMA

MELTING AND HOLDING FURNACES

Kozma Melting and Holding Furnaces are being specified by die casters, permanent molders and aluminum producers . . . where highest quality metal is a "must."

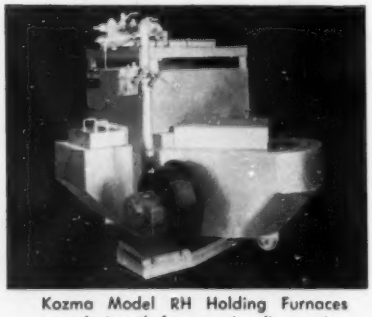
TILT-TYPE MELTING FURNACE



These new Kozma Furnaces for aluminum or magnesium melting combine all the advantages of Kozma exclusives . . . **Radiant-Panel firing, "Pre-Temp" hearth or flue, a special re-melt well, and functional tilting design.** Integral ladle suspension arms permit easy ladle removal.

Kozma Tilt-Type Furnaces provide faster melting rate, highest possible metal purity, increased fuel economy, lower melting costs. Capacities from 600 to 2,000 lbs. per hour.

HOLDING FURNACE



Kozma Model RH Holding Furnaces are designed for use in die casting and permanent molding. Roller bearing wheels and a unique dipwell permit integral installation. Bath capacities and dipwells can be designed to meet your particular requirements.

Write today for complete information!

J. A. KOZMA Company
2471 WYOMING
DEARBORN, MICHIGAN
Industrial Processing Furnaces . . . since 1928

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news of industry & associations

Continued from page 19

Haller, Inc.—*M. C. Sarnes* has been named general manager.

SARNES

LEMMER

Vanadium-Alloys Steel Co.—*Orlo I. Lemmer* has been named to the position of manager, Metallurgical Service.

Amplex Division, Chrysler Corp.—*William R. Donnelly* has been named president. He replaces *William P. Balthrop*, who was named president of the Airtemp division of Chrysler.

American Zinc Institute—*Richard A. Hicks* has joined the Detroit staff as a market development engineer.

Magnaflux Corp.—*Bruce D. Tyler* has been made instructor of the company's five-day nondestructive testing training course.

National Lead Co., Doehler-Jarvis Division—*Arne E. Swanson* has been appointed assistant plant manager, and *Clyde A. Wilcox*, works manager, at the Batavia, New York plant.

The Dow Metal Products Co., Division—*Ronald C. Forrest* has been promoted to section head of Technical Service and Development for military applications.

Harbison-Walker Refractories Co.—*John H. Owen*, a Chicago district sales manager, has been named to the Board of Directors of Harper-Wyman Co. *Thomas Welfer* has been elected secretary of Harbison-Walker's Board. He succeeds *G. F. Cronmiller, Jr. P. C. Mitchell* and *J. C. Willey* have been elected to the Company's Board.

WELFER

MITCHELL

WILLEY

more Industry News on page 65

Hot-Work Tool Steels

For Every Need

When you need Hot-Work Tool Steels, for standard or severe applications, turn to UDDEHOLM for a superior Swedish quality to satisfy your most exacting requirements. Our mills in Sweden produce grades that have exceptional toughness, will retain high hot-hardness and resist heat-checking, to give long production runs.

Specify these grades for economy with UDDEHOLM Swedish Quality!

For Brass and other high-temperature alloy Die Casting, Hot Press Forging and Hot Extrusion Dies — UDDEHOLM'S exclusive **UHB CALDUR • UHB CALMAX**
For Aluminum, Magnesium, long-run Zinc Die Casting — **UHB ORVAR** — SAE H-13
For Aluminum Hot Extrusion Operations — **UHB SPECIAL** — SAE H-12
For Zinc Die Casting — Cold Hobbed Dies — **UHB PREMO** — SAE P-4

UDDEHOLM Tool Steel Service Centers stock
the grade, size and shape of Hot Work or Cold Work tool steels you need — ready for prompt delivery to you!

Send for Technical information and stock list on any grade you require.

UHB TOOL & DIE STEELS COLD ROLLED SPRING STEELS

UDDEHOLM CO. OF AMERICA

155 East 44th St., New York 17, N. Y., MUrray Hill 7-4575

Uddeholm Steels—used by American Industry since 1820

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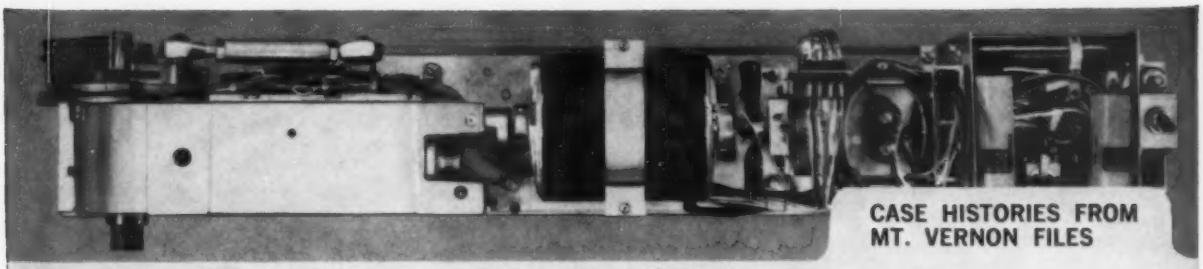

CASE HISTORIES FROM
MT. VERNON FILES

The STANLEY® MAGIC-DOOR Electric Operator . . . another open and shut case for die casting– ...MT. VERNON die casting

From Stanley* comes this new electric, automatic door opener, compact and economically priced and amply powered to handle all new or existing doors up to 42″ widths — weights up to 150 lbs.

The Operator, a compact power package, measures only 5½″ x 6″ x 31″— weighs less than 40 lbs. — contains 5 major assemblies including a transmission which is the muscle. Although the transmission case is somewhat smaller than an ordinary shoe box, it contains all the gears, cams, bearings, linkages, etc. for converting the high speed output of the motor into a mighty and instantly responsive door-swinging thrust.

Shown here are the 5 Mt. Vernon die castings which make up the transmission case—3 cover plates—1 bridge plate and 1 main housing. Your practised eye will tell you that the latter is a very complex casting — a compact casting designed with enormous built-in strength to meet its service load strains.

Producing castings of this nature is never easy — but rarely a problem at Mt. Vernon for we offer manufacturers more than die casting production. Ours is a four-fold service • designing, die making, casting and machining • a coordinated service — all under one roof in 200,000 sq. ft. of space. The most advanced independent die casting plant in the country.

Complex or simple, why not bring your die casting problems to us. What we do for Stanley and others we can surely do for you. Just call your nearest Mt. Vernon Field Salesman or our home office.

*The Stanley Works, New Britain, Conn.

MT. VERNON DIE CASTING CORPORATION

Stamford, Connecticut

FIELD SALESMEN—BALTIMORE, MD.: Mr. C. M. Gordan, 919 St. Paul St. • **BROOKLYN, N. Y.:** Mr. Robert V. Moore, 2317 Plumb 2nd St. • **MARIETTA, N. Y.:** Mr. Burt J. Meldrum, Olanco Road • **PITTSBURGH, PA.:** Mr. Andrew W. Anderson, 300 Pasadena Drive So. • **STAMFORD, CONN.:** Mr. Anker Anderson, Cascade Road • **VALLEY FORGE, PA.:** Mr. G. T. McMaster, P. O. Box 115

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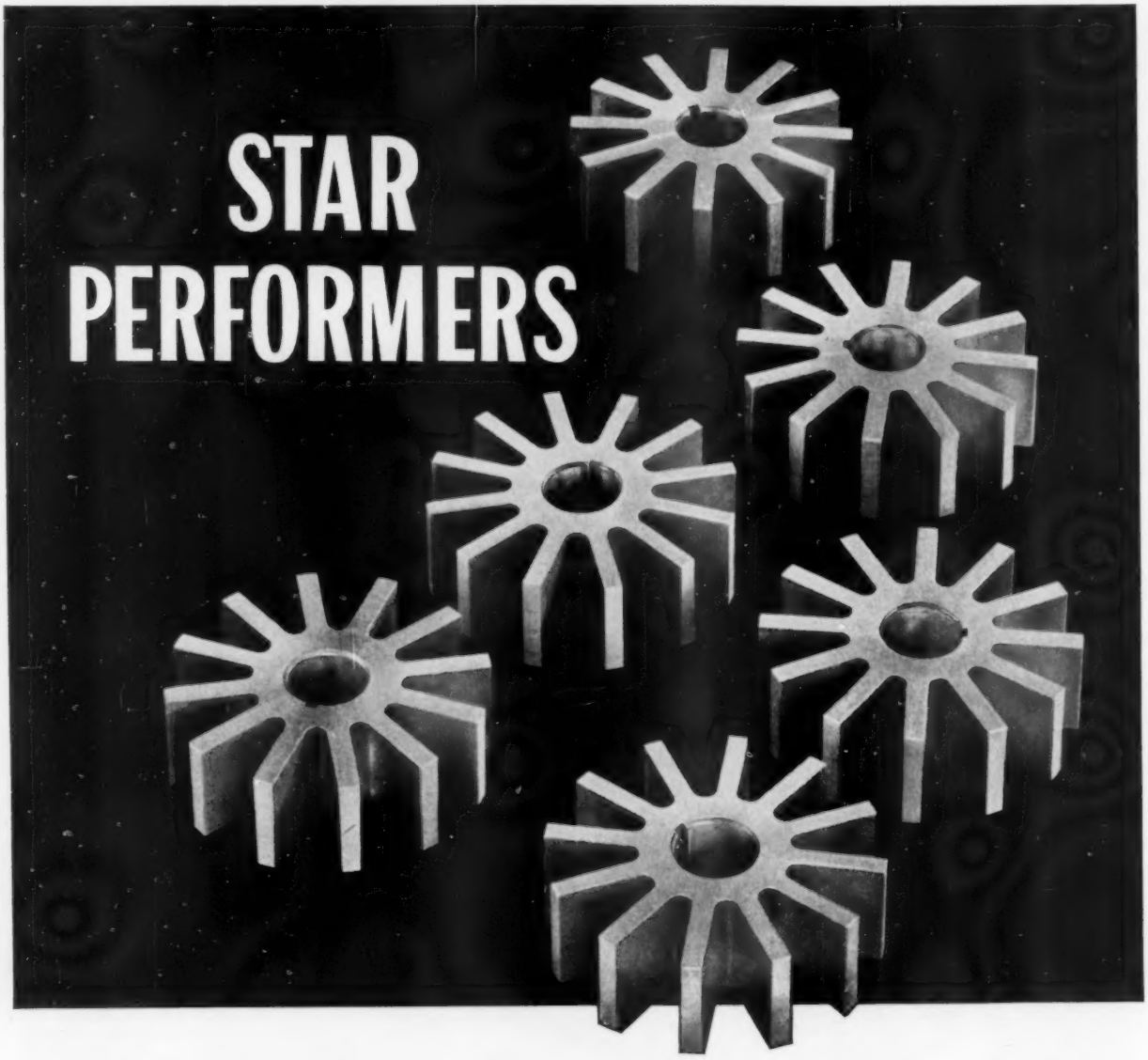


Madison-Kipp zinc and aluminum die castings

Impellers for a ventilator pump must be held to extremely close tolerances.

Madison-Kipp showed the way to produce these parts with a bare minimum of secondary operations.

If it is an intricate shape, a question of close tolerance, a problem of casting-in inserts or just a dependable source for quality castings in quantity, the engineering skill, die making experience and years of manufacturing background of Madison-Kipp are available to you.

We have a 24-page book showing some of the die casting problems we have solved, and containing information on other Madison-Kipp products. A copy is yours for the asking.

kipp

MADISON-KIPP CORPORATION

213 Waubesa Street • Madison 10, Wisconsin, U.S.A.

Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High-Speed Air Tools

Circle No. **33** on Reader Service Card

news of industry & associations

Continued from page 19

Was Western Brass — now it's Olin Brass

A prominent trade name in the metals industry, Western Brass, will be changed for uniformity and closer identification with Olin Mathieson Chemical Corporation. The new name is Olin Brass. Products, customer services and sales policies will not be affected by the change.

Generator manufacturer bought by Ajax Magnethermic

Ajax Magnethermic Corporation announced a joint acquisition of the Safety Electrical Equipment Corporation. Safety Electric manufactures special motor generators and controls, including high frequency motor generator sets.

Iranian student presented Irving B. Hexter award

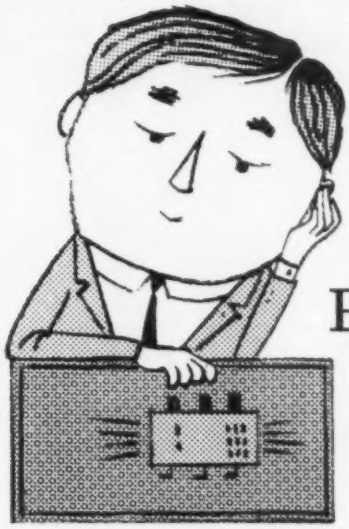
Vladislav Malakhof, an exchange student from Teheran, Iran, has been awarded a $350 scholarship by the Metal Powder Industry Federation. The award was established

MR. MALAKHOF (left) accepts the award from Charles Stevens, Instructor of Mechanical Engineering.

by PRECISION METAL MOLDING magazine to honor Irving B. Hexter, its founder. Presentation took place in Cleveland, Ohio, at a recent M.P.I.F. meeting where Lewis W. Davis of Metal Hydrides, Inc. accepted the award for Mr. Malakhof.

Mr. Malakhof is a senior majoring in mechanical engineering at the University of Missouri.

Circle No. 9 on Reader Service Card



wish I HAD a PENNY for every CLICK . . .

When an Electrical Control Device clicks through its 100,000,000th operation, there's probably a BADGER DIE casting involved!

BADGER DIE CASTING CORP.
201 W. Oklahoma Avenue, Milwaukee 7, Wisconsin

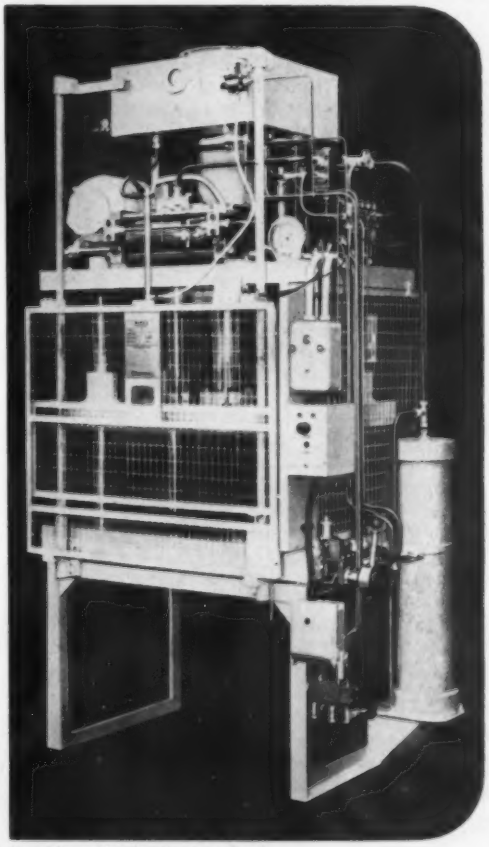
SPEED UP YOUR TRIM OPERATIONS!

Here's Bipel's 50-ton Semi-Automatic Trim Press that gives you a faster approach and a faster advance through the work! Dry cycle time is only 3 seconds. This flexible, clean-trimming unit offers a choice of 3 pressures . . . 17, 34 or 50 tons (intensified within the press) . . . semi-automatic or manual control. Complete operator safety, too. Write for illustrated bulletin.

B. I. P. ENGINEERING LTD.
Sutton Coldfield, England

RALPH B. SYMONS ASSOCIATES, INC.
3569 Main Road, Tiverton, R. I.

BIPEL®



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NOW AVAILABLE

TO DESIGNERS AND PRODUCT PLANNERS

*PDCS
PROTOTYPE DIE CASTING SERVICE

What Is PDCS?

Prototype Die Casting Service is a new process which allows the low cost creation of die castings . . . in small quantities . . . which look, feel, finish and perform remarkably like production die castings.

Why Was PDCS Developed?

Over a year and a half of intensive research and test was devoted to the development of PDCS to provide a method of supplying sample die castings for test purposes . . . without the problem of underwriting permanent tooling charges.

How Can You Use PDCS?

If part of the product you are planning is to be a die casting and you need prototype die castings to . . . supply your customers with samples . . . test the function of the completed assembly . . . gauge sales appeal by market-testing . . . judge the "feel" or appearance of the die casting . . . PDCS represents the answer you have been looking for.

How Much Does PDCS Cost?

Amazingly little. The factors of shape, size, complexity and quantity all play a part in determining price.

How Can You Start To Work With PDCS?

If you have prints, models, sketches or just an idea of what you need in a die casting . . . we are ready to help. Just fill out the coupon . . . clip and mail today.

NEWTON-NEW HAVEN CO.
(870) Third Avenue
West Haven, Conn.
NEWTON NEW HAVEN

CUSTOM PRODUCERS OF DIE CASTINGS

I have a problem to which PDCS may be the answer. Without cost to me or my company . . .

☐ Prints ☐ Models ☐ Sketches are being forwarded under separate cover. Please submit your cost estimate.
☐ Have your representative call.
☐ Send me your free folder, "PDCS . . . Prelude to Production".

B

NAME:_____
TITLE:_____
COMPANY:_____
ADDRESS:_____

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Nine Fill Top MPIF Positions

IRVINE

ROLL

BURGESS

LOWE

SCHNEIDER

KOEBEL

WEBB

BLUE

ALMQUIST

New officers of the Metal Powder Industries Federation and its trade associations were elected at a recent meeting held in Cleveland, Ohio.

W. Arthur Irvine of The Maytag Co. is the new MPIF president. He has served on the Board of Governors and is currently on the Board of the In-Plant Powder Metallurgy Association.

Kempton H. Roll was reappointed executive secretary and treasurer of the Federation. Mr. Roll is also national secretary of the American Powder Metallurgy Institute.

Trade associations comprising the Federation elected officers as follows: Robert C. Burgess of Burgess-Norton Mfg. Co. as president of the Powder Metallurgy Parts Manufacturers Association; Earl Lowe of Greenback Industries, Inc. as president of the Metal Powder Producers Association; Peter V. Schneider of International Business Machines Corp. re-elected as president of the In-Plant Powder Metallurgy Association; Norbert K. Koebel of Lindberg Engineering Co. re-elected as president of the Powder Metallurgy Equipment Association; John C. Webb of the Magnetic Core Corp. as president of the Metal Powder Core Association; Roy E. Blue of Amplex Division of Chrysler Corp. as president of the American Powder Metallurgy Institute; and Donald L. Almquist of Stockpole Carbon Co. as president of the Ferrite Manufacturers Association.

Circle 26 ⟶

fishing's
better because—

better because HOEGANAES stainless steel powders improve AIREX spinning reel parts production

The parts are brake drums and guides, produced by THE LIONEL CORPORATION, using HSIC 316L stainless steel powder. Assembly problems and extra production operations were eliminated.

In addition, Hoeganaes stainless powders provided better corrosion and wear resistance qualities. Cost savings of 30% and 26% when compared to former machining methods.

Get more facts about HSIC high alloy powders—write for free literature; ask for Bulletin #128.

HSIC

HOEGANAES SPONGE IRON CORPORATION

RIVERTON, NEW JERSEY

SALES REPRESENTATIVES IN PRINCIPAL CITIES

Circle No. 43 on Reader Service Card

PARAMOUNT
Die Castings
AT WORK
No. 8 of a Series.

RADIAL-ARM SAW
gets Rigidity with Light Weight from
PARAMOUNT DIE CASTINGS

A TUBE CAP
B LOWER CARRIAGE SLIDE
C UPPER CARRIAGE SLIDE
D BLADE GUARD

Central Specialty Division, King-Seeley Thermos Company, selected Paramount to supply the die castings for critical parts of this high quality Craftsman saw, made exclusively for Sears, Roebuck and Co. Why Paramount? Because of Paramount's well-known engineering and production know-how—Paramount's ability to consistently meet the highest standards of precision at lowest possible cost—Paramount's careful scheduling which assures deliveries that fit customers' production schedules.

It will pay you to look to PARAMOUNT . . .

If your product incorporates zinc or aluminum die castings, or you're considering them, investigate Paramount's **complete** services—from drawing board to finished part.

PARAMOUNT Die Casting Co.
(A subsidiary of TALON, INC.) ST. JOSEPH 1, MICHIGAN
Three complete plants—two in St. Joseph, Mich., one in Seymour, Ind.

AWARDS OF DISTINCTION WINNERS

Continued from pages 32 & 33

D.C. MOTOR ARMATURE . . .

milled a brass spider with pieces of magnetic iron inserted into the slots and staked in place. Out of powders, a sintered steel piece with a continuous outer ring is made. A bronze compact is then formed and the green compact internested in the sintered steel part. During sintering the bronze compact expands to form a tight mechanical bond with the steel.

The piece is finished by machining away the outer ring of sintered iron.

MOTOR TOGGLE . . .

suspension for the phonograph motor and a simple means of getting the three different speeds needed on a modern record player. Close tolerances, roundness of the two hole bores and parallelism of the two bores are requirements for this part.

PINSPOTTERS . . .

part (left) it wasn't economical. By switching to powdered brass the cost was cut 90% and the self lubricating properties improved the slide characteristics to prevent galling and binding.

Circle No. 49 on Reader Service Card

Helpful Hints for Die Casters

—from Bethlehem's Tool Steel Engineer

How to Combat Heat-Checking in Hot-Work Tools

Tools which are moderate in hardness do an effective job of resisting heat-checking. However, soft tools wear rapidly, and chances are good that they may deform under service loads. Therefore, a compromise is always necessary in making hot-work tools.

Hot-work tools should be soft enough to avoid rapid heat-checking, yet hard enough to avoid deformation under the service load. How does one determine the wide range of hardness which will meet these requirements? Experience is by far the best teacher. When the hardness range is established, the hardness of the tool is always maintained on the high side of the range to provide maximum wear-resistance.

Hot-work tools which give satisfactory service are normally removed from service because of wear. Examination of such tools usually shows the working surfaces to be severely heat-checked. This condition, where wear and heat-checking have progressed simultaneously, represents the proper working level of hardness. The use of a higher hardness would cause failures from gross cracking or from heat checks; lower hardness would allow more rapid wear.

Steel *for Strength . . . Economy . . . Versatility*

Super shock-resisting and air-hardening BEARCAT is ideal for many hot-work tools

Bearcat is Bethlehem's super grade of shock-resistant air-hardening tool steel. It's ideal for many tough hot-work applications . . . dummy blocks, rivet sets, hot headers, gripper dies, and extrusion-press support tooling, for example. When tempered in the higher range, it's an excellent hot-work performer where the operating conditions do not require the temperature of the tool to be higher than 1000 F.

Bearcat has high wear-resistance. And because it's an air-hardening grade, it minimizes quenching hazards and distortion in heat-treatment.

Bearcat is also ideal for applications involving shock, because of the way it withstands repeated impact, yet keeps coming back for more.

For a really tough tool steel—one that cuts operating costs—you'll find it hard to match Bearcat. Full information is available from your Bethlehem tool steel distributor.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Circle No. 10 on Reader Service Card

DIE CASTINGS CAN BE ADHESIVE

· PROPERTIES OF AF-6 ADHESIVE FILM

Type

An elastomer-phenolic high strength thermosetting dry bonding film. Exceeds Mil. Spec. MIL-A-5090D for structural bonding honeycomb sandwich construction.

Service Temperature

Minus 70°F to plus 180°F

Shear Strength

3000 psi @ −67°F
3040 psi @ +75°F
1750 psi @ +180°F

Peel Strength

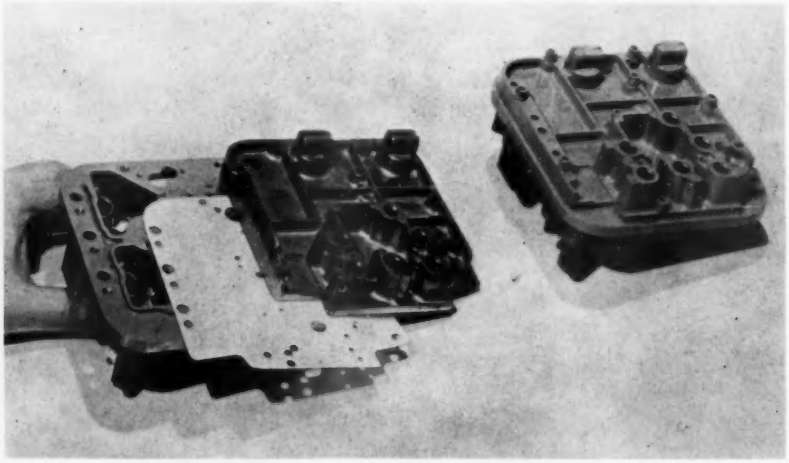
95 to 100 lbs. per inch of width

General

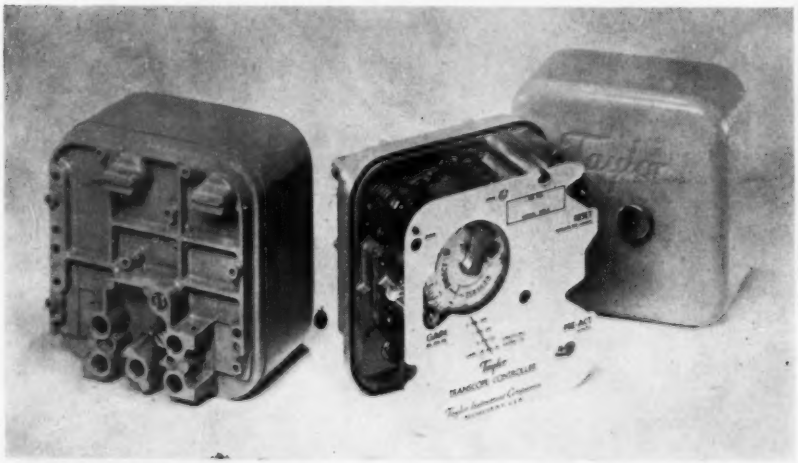
Excellent resistance to water, 20% salt spray, hydraulic and aromatic fuels. Provides uniform adhesive thickness through the entire joint. Adhesive confined to bonding area, no solvents, or shrinkage. Good shock and fatigue resistance. Available in varying sheet widths and thicknesses, can be die cut to complicated shapes.

TWO MATING ALUMINUM DIE CASTINGS are adhesive bonded now instead of bolted. The result is a 50% production cost saving for Taylor Instrument Companies. In addition, adhesive assembly techniques solved a difficult manufacturing problem. It produced a superior, better appearing manifold assembly. It permitted use of lower cost materials. Field failures were eliminated, and adhesive bonding reduced rejection rates to practically zero. Leak testing operations dropped from 100% to 10% of the production.

The two manifold sections are bonded and sealed with die cut Scotch-Weld brand film adhesive AF-6 made by Minnesota Mining



MANIFOLD SECTIONS and die cut film adhesive ready for assembly.



FINISHED, BONDED unit ready to assemble into a control instrument.

ASSEMBLY of manifold sections. Steel screws apply bonding pressure.

BONDED

and Mfg. Co. This film adhesive provides uniform thickness throughout the joint and continuous contact between mating surfaces. This gives sealing and bonding in a single operation.

The assembly is a pneumatically controlled manifold for a process controller.

With the previous fastener and sealing method, each individual manifold section had to be masked, painted and baked before the assembly operation. The sealer used could not withstand the enamel baking temperature. After baking the sealer was sprayed onto the mating surfaces and the two sections assembled with stainless steel bolts. Sealer thickness was difficult to control; the result, leakers. Also, to prevent disassembly, the recess for the head of each bolt had to be filled.

With the adhesive assembly method, the die cut adhesive film is tacked to one manifold surface. The two sections are then assembled with plain steel screws. These screws are only to apply pressure for the adhesive during curing. The entire assembly is then spray painted with an epoxy enamel and cured for one hour at 350°F. This operation simultaneously cures both the adhesive film and the enamel.

Because of the high strength of the bonded assembly (over 3000 psi), the screws could be removed after curing. However, the labor cost of removing the screws generally exceeds their value. Another advantage is that the heads of the screws are not filled as a separate operation. The screw heads have been painted and blend in with the body. With the previous method, the heads stood out against the gray enamel paint.

Your
CASTING QUALITY
Begins With
Foseco®

Foseco products for every casting application are compounded from quality raw materials scientifically blended to assure product uniformity. Each is quality controlled in Foseco's laboratories, production tested in Foseco's experimental foundry.

And Foseco's Technical Service is always available without charge or obligation. Call or write for competent, professional advice on your problem castings—or your routine foundry applications.

Foundries everywhere recognize Foseco superiority—for improved product quality and for lower casting costs.

Foseco®

® FOSECO, INC.
P. O. Box 8728
CLEVELAND 35, OHIO
Telephone: BErea 4-3551

A world-wide organization serving the chemical and metallurgical needs of the entire metal-casting industry.

Circle No. 60 on Reader Service Card

"TIFFIN POTS LAST LONGER"

This is a report that we continue to receive from our customers.

Standard melting kettles and machine pots direct from stock are available for all non-ferrous metals.

Special pots are made to your specifications.

We also furnish the following parts in Tiffin alloyd iron or alloyd steel:

- PLUNGERS
- NOZZLES
- GOOSENECK NOSES
- THERMO COUPLES
- INGOT MOLDS
- BAR STOCK

All parts are especially engineered to give the best possible service in the die casting field.

OVER 50 YEARS EXPERIENCE in the manufacture of quality pots and die equipment.

FREE BROCHURE lists stock pots.

Be Thrifty — Be Wise
Use The Best . . .

THE TIFFIN FOUNDRY, INC.
Phone: Gibson 7-3991
TIFFIN, OHIO

Circle No. 53 on Reader Service Card

PMM

book reviews

The Brittle Fracture of Steel, *W. D. Biggs; Pitman Publishing Corp., New York, 1960. 420 pages. $15.00.*

• • •

This book is intended to provide a comprehensive review of present knowledge on the brittle behavior of structural steels. Most previous studies of brittle fracture in steel are based on scattered data, conducted for strictly practical purposes to rectify troubles immediately at hand. This has led to differing opinions and apparant discrepancies.

Now, more fundamental investigations may reconcile the differing approaches to the problem made by the engineer, metallurgist, and physicist. This book reports on these investigations and puts emphasis on the metallurgical features.

The factors influencing plastic metal flow are discussed in light of current theories on fracture.

Structural Aluminum Design; *Reynolds Metals Company, Richmond, Va., 1960. 232 pages.*

• • •

Available without charge to qualified individuals making requests on company letterheads, this book covers design information needed to utilize aluminum in structural applications. It includes tables of properties, applications, specifications, maximum allowable stress values, high and low temperature properties, alloy data sheets, weights, and other information.

Tables list section properties of commonly used structural shapes. Other tables list reactions and moments for simply supported, fixed-end, and continuous beams under various types of loads.

Examples show the application of strength of materials equations to design problems.

5th in a series of POWDERED METAL PARTS applications by REESE

Powdered Metals . . .

NEW WAY TO MAKE PADLOCKS

By-passing castings and extrusions, the major parts of this brass padlock for the government are made of Reese powdered metal parts. Higher precision and lower cost result by designing the lock to take full advantage of the powder metal process. All parts meet government specs MIL-B-12128A.

FREE BROCHURE

"How to Cut Precision Parts Costs with the Remet Powdered Metal Process" shows how the Reese Corp. can help you. Send for your copy today.

REESE
METAL PRODUCTS CORPORATION
537 Howard Ave., Lancaster 10, Penna.

Gears • Pinions • Cams • Ratchets
Oilless Bearings • Bushings
Machine and Structural Parts in
COPPER • BRASS • IRON
ALLOY STEEL • NICKEL SILVER
COPPER INFILTRATED IRON

Circle No. 48 on Reader Service Card

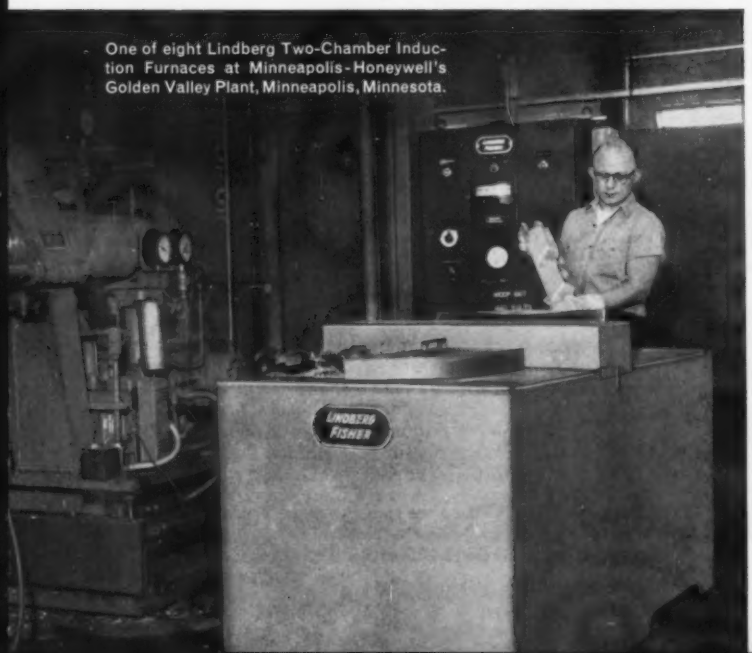
ART GEORGE has a good word to say for Lindberg Melting Furnace performance

QUOTE

Mr. Art George, Senior Production Engineer, Golden Valley Plant, Minneapolis-Honeywell Regulator Company, Minneapolis, Minn.

"Our installation of eight* Lindberg-Fisher Two-Chamber Induction Melting and Holding Furnaces has given remarkable service for more than four years. In this period, with the help of a well executed Honeywell maintenance program, the installation has been unusually trouble-free. Only one of the eight furnaces has required relining over this long period. Handling more than 1,000,000 pounds of aluminum and zinc annually, the installation has unfailingly provided the consistently high quality of metal our precision instruments require."

**Altogether, 44 Lindberg Furnaces are in operation in various Honeywell plants.*



One of eight Lindberg Two-Chamber Induction Furnaces at Minneapolis-Honeywell's Golden Valley Plant, Minneapolis, Minnesota.

These eight Lindberg-Fisher Induction Furnaces melt and hold aluminum and zinc for die casting gas valve housings and other component parts. They are located at the die casting machines where ingot and scrap can be melted and held at the desired casting temperature in one convenient unit. Magnetic fluxing and stirring insures uniform temperatures and consistently clean metal.

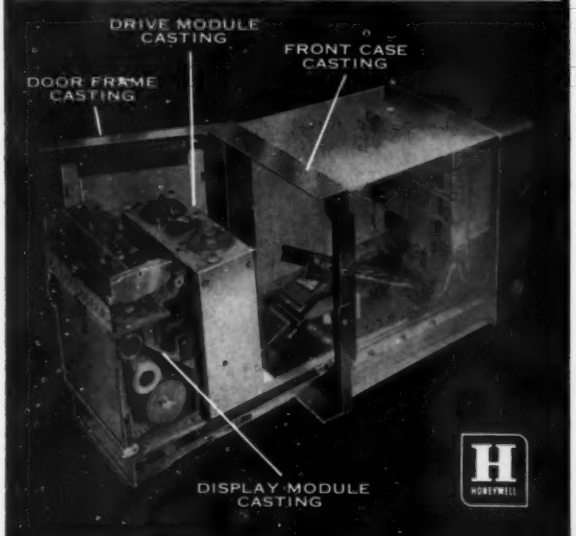
In any production process where aluminum needs heat there is Lindberg equipment to apply it most economically and efficiently. Furnaces for melting and holding, casting stations, re-melting or heat treating are available in all capacities, electric or fuel fired. Get in touch with your Lindberg Field Engineer (see your classified phone book) or write us direct. Lindberg-Fisher Division, Lindberg Engineering Company, 2463 West Hubbard St., Chicago 12, Illinois.

Los Angeles plant: 11937 S. Regentview Avenue, Downey, California. In Canada: Birlefco-Lindberg Ltd., 15 Pelham Ave., Toronto 9, Ont. Also, Lindberg plants in Argentina, Australia, England, France, Italy, Japan, South Africa, Spain, Switzerland and West Germany.

Circle No. 62 on Reader Service Card

LINDBERG
heat for industry

HOW HAMPDEN BRASS HELPED HONEYWELL'S *ElectroniK 17**



The ElectroniK 17 is Minneapolis Honeywell's all-new potentiometer . . . a compact, highly sensitive instrument for thermocouple or millivolt actuation.

*Trademark Minneapolis-Honeywell Regulator Co.

Honeywell engineers wanted 4 major castings for the front case, the door frame, the drive module, and the display module. Because the ElectroniK 17 was to have more features in a small space than any other potentiometer, intricate corings and thin walled castings were a "must." Honeywell's demand for peak performance in this new device was coupled with an equal insistence on quality components whose cost would keep the ElectroniK 17 competitive.

HAMPDEN BRASS & ALUMINUM'S DIE CASTINGS MET ALL THESE REQUIREMENTS

Aluminum Die Casting Reduced Cost, Met Desired Performance. The clean, smooth surface of the finished castings required no additional and expensive surface finishing. The inherent strength of top grade aluminum permitted the thin wall construction needed.

HAMPDEN BRASS HAD ALL THE CASTING FACILITIES FOR QUALITY, SPEED AND ECONOMY

Two 1000 ton die casting machines quickly turned out the intricately cored castings, accurate in every detail. Hampden Brass engineers and production personnel worked closely with Honeywell's designers from the initial tool designing right through to final production.

Let Hampden Brass Solve Your Casting Problems

Send for Free Brochure, "Behind the Scenes," a digest of Hampden Brass facilities.

HB

Hampden Brass & Aluminum Company

Established 1903

SPRINGFIELD, MASSACHUSETTS

Complete Pattern, Mold and Die Shop. X-ray, Laboratory and Heat Treating Facilities

NON-FERROUS CASTINGS:

Sand, Permanent Mold, Die and Structural Fiberglas.

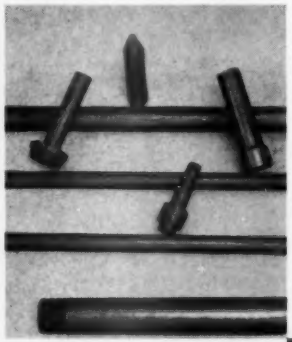
Circle No. 23 on Reader Service Card

Q WHAT ONE MATERIAL A

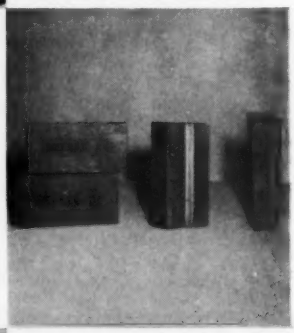
can be used up to 3000°F—is nearly impervious to abrasion and corrosion—can be formed to ± .005 in./in.—and even withstands molten aluminum?

Carborundum's nitride bonded silicon carbide — REFRAX® refractory

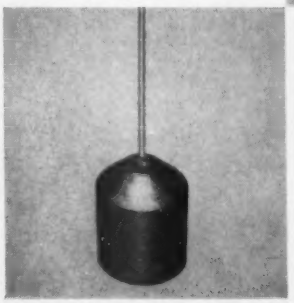
This extra hard, very strong material looks like cast iron—wears like no other known refractory or cement—yet costs little more than standard silicon carbides. And it's worth?—you judge from the examples below.



EXAMPLE: Cast iron pyrometer tubes immersed in molten aluminum average 70 hours' life. When replaced with REFRAX tubes, life is *ten times* longer. Iron pouring spouts in molten aluminum cut out in an hour. Contamination of the melt is "distinct." Life of REFRAX spouts is often several hundred hours... and there's no longer contamination.



EXAMPLE: REFRAX brick, rectangular or with tongue and groove, used in hot walls are easy to clean and maintain, resist NaCl, KCl and cryolite fluxes added to metal, speed up heat conductivity and extend wall life. Life of REFRAX hot walls consistently proves to be several times that of fireclay walls.



EXAMPLE: Automatic precision pouring of molten aluminum is governed by REFRAX float that serves as the "nerve end" of electronic system. Refractory float is of simple design, requires practically no maintenance and provides a life 4 to 5 times that of floats made of other materials.

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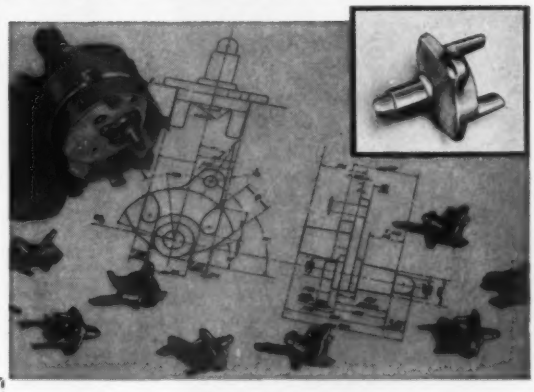

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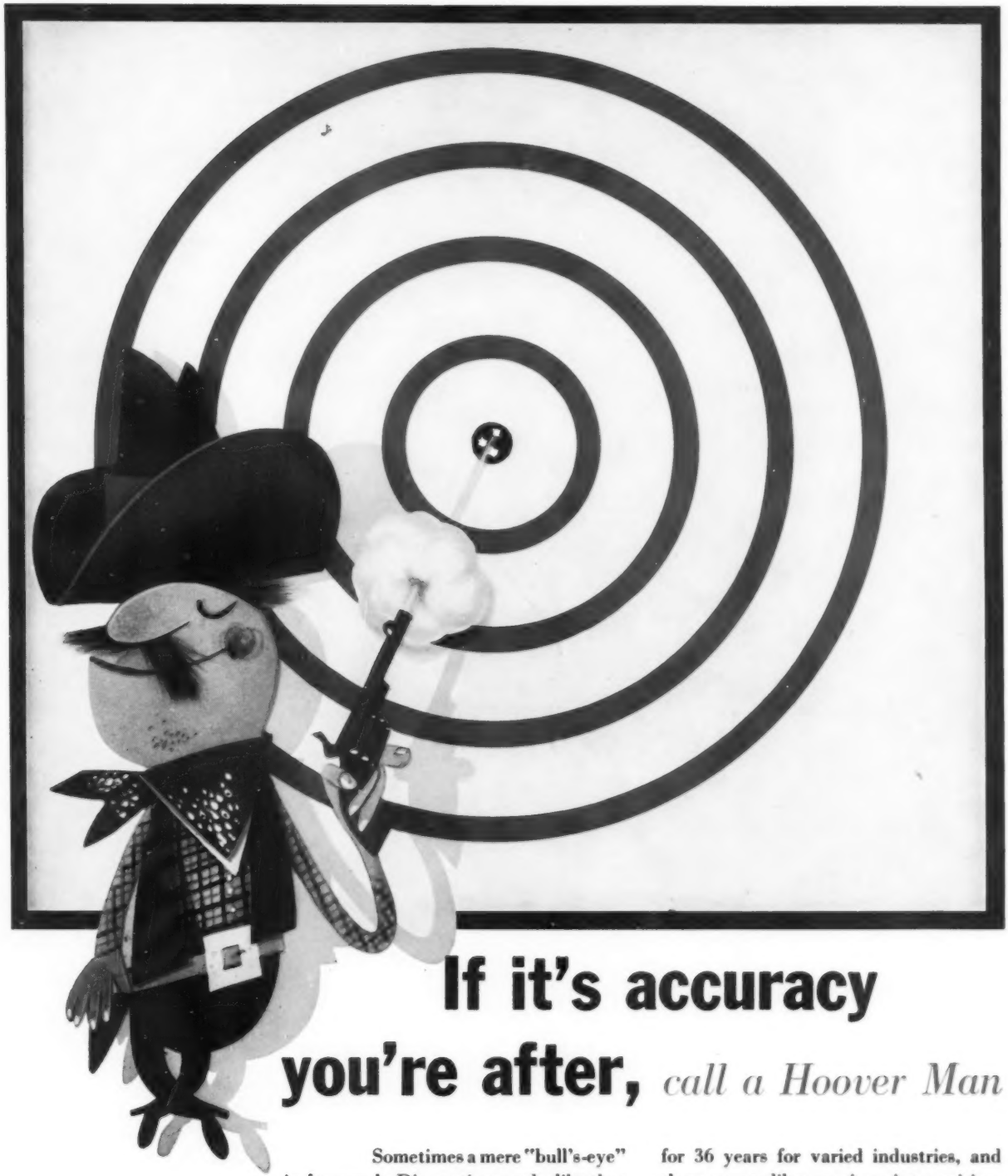

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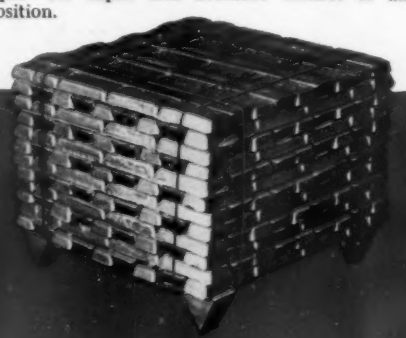

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